

**ANNEX I**  
**SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN**



**U.S. Army  
Chemical Materials Agency**

**Project Manager for  
Non-Stockpile Chemical Materiel**

**Explosive Destruction System  
at Dugway Proving Ground  
Safety, Health, and Emergency  
Response Plan**

**Final  
Revision 2**

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**March 2009**

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## SECTION 1

### INTRODUCTION

This Safety, Health, and Emergency Response Plan (SHERP) is written in support of the Explosive Destruction System (EDS) operations at Dugway Proving Ground (DPG), Utah, and is a site- and mission-specific plan for safe operation of the EDS at DPG. The SHERP was developed in accordance with U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulation 29 Code of Federal Regulations (CFR) 1910.120, *Hazardous Waste Operations and Emergency Response*, and guidelines established by the U.S. Army Corps of Engineers Manual 385-1-1, *Safety and Health Requirements Manual* (2003). Any changes to this plan that are not editorial in nature will not be permitted unless express written authorization is issued by the Project Manager for Non-Stockpile Chemical Materiel (PMNSCM).

#### 1.1 EDS at DPG Site Description

The items to be destroyed are currently stored in Igloo G at DPG. **Figure I-1-1** shows the location of DPG and **Figure I-1-2** shows the location of Igloo G and the EDS site. A generic layout of the EDS site is provided in the Site-Specific Monitoring Plan (**Annex E**). The EDS will be set up at a suitable location near Igloo G to minimize the distance the items must be moved, while maintaining the prescribed explosive safety areas around both Igloo G and the EDS.

The EDS at DPG will be operated by the PMNSCM System Operations Group. Destruction operations at DPG will be performed using an EDS Phase 2 unit.

The EDS will be located inside an Environmental Enclosure (EE). The EE is a commercially available structure approximately 30 feet wide by 60 feet long by 20 feet tall at the centerline. Before operations, the EE will be erected onsite. A layer of

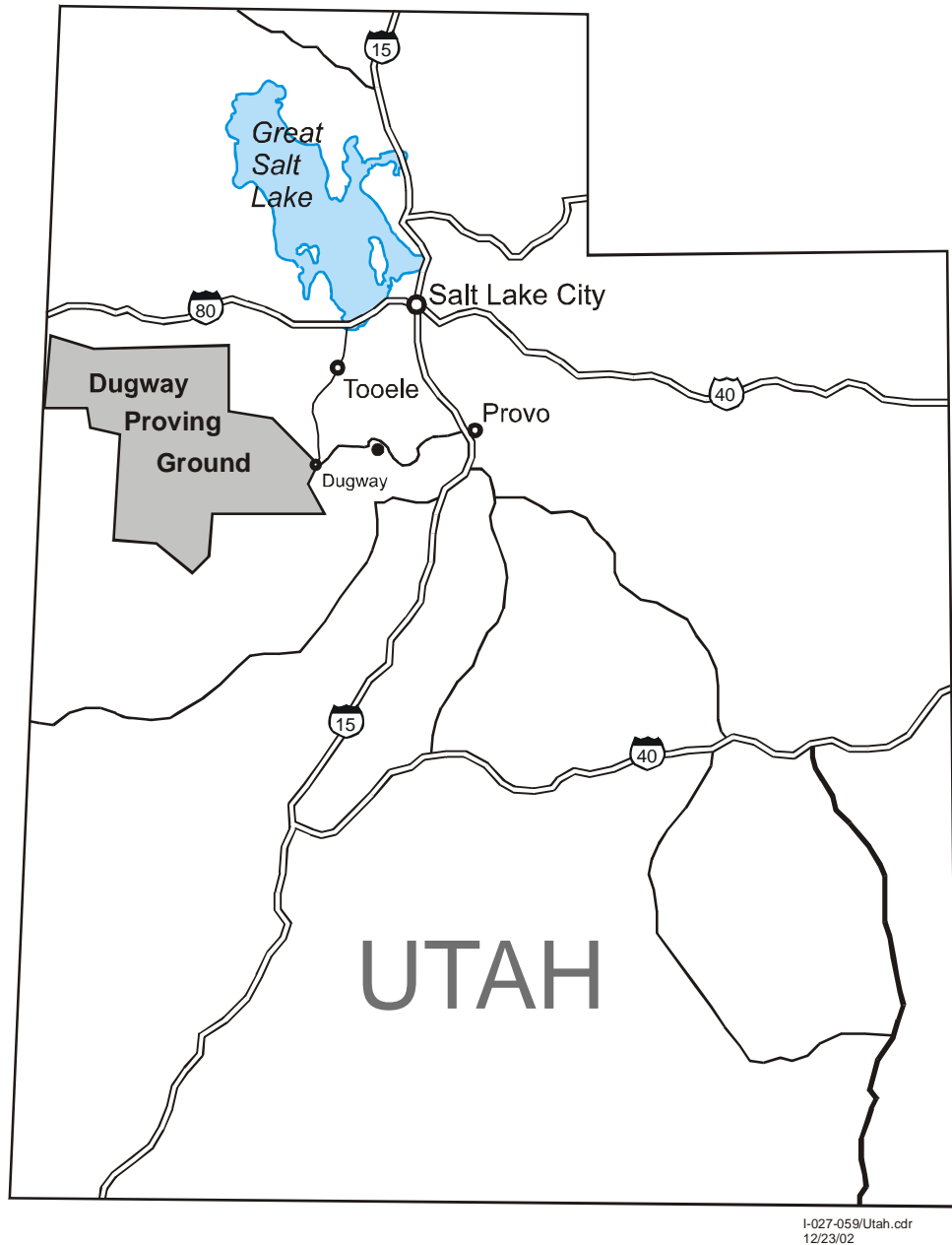


Figure I-1-1. Location of DPG

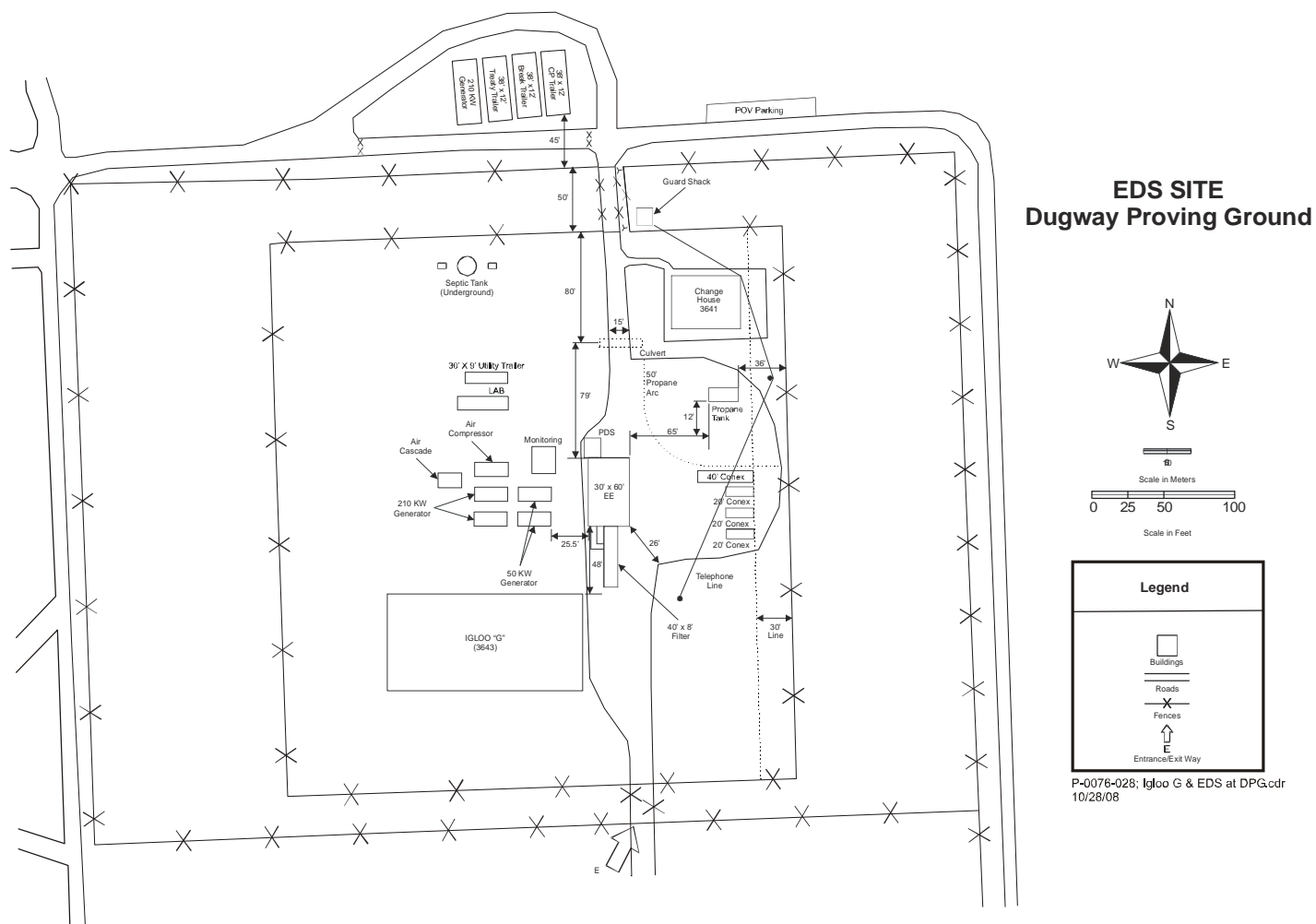


Figure I-1-2. Location of Igloo G and the EDS Site at DPG

impermeable plastic sheeting will be placed on the ground inside the EE and turned up at the walls to prevent spills from contaminating soil, surface water, or groundwater. After being secured in place, the EE will be connected to the air filtration system located on the downwind side of the structure.

During treatment operations, the interior of the EE will be monitored for chemical agent. Also, the exhaust air from the EE will be filtered and monitored during operations.

## **1.2 EDS at DPG Functional Description**

The following paragraphs give a general description of the EDS at DPG.

During EDS operations, the following actions will take place:

- a. Deliver the overpacked item(s) to the EE.
- b. Unpack the item(s) inside the EE.
- c. Assemble the item(s) into the Fragment Suppression Systems (FSS) with shaped charges.
- d. Load prepared FSS into the explosion Containment Vessel (hereafter referred to as vessel), close and seal the door, and confirm the door seal.
- e. Remotely detonate explosive-shaped charges.
- f. Transfer treatment reagent to the vessel.
- g. Heat (fill-dependent) and agitate the contents of the vessel.

- h. Monitor the vessel temperatures and pressures.
- i. Sample and analyze liquids in vessel.
- j. Drain liquid waste from the vessel.
- k. Treat/rinse the vessel with water (temperature, volume, and length of agitation are based on the chemical agent being treated).
- l. Drain rinse water from the vessel.
- m. Flush vapors from the vessel with helium through the waste drums/filters.
- n. Sample and analyze vessel headspaces.
- o. Open the vessel door, remove solid wastes, and rinse the vessel with water.

Munitions that are empty (do not contain chemical fill) will be treated in the EDS with water heated to 60°C from the water supply tank. The heated water treatment will be followed by a single ambient temperature water rinse. All other procedures will be identical.

The EDS will be prepared and operated in accordance with the EDS Standing Operating Procedures (SOPs). In addition to working the standard normal workweek, EDS operations may be conducted on weekends and holidays.



### **1.3 Accident Prevention Plan**

All EDS at DPG workers are responsible for accident prevention. The EDS Safety and Health Officer (SHO) will administer the accident prevention program and maintain references and other documentation relating to safety and accident prevention at the EDS at DPG site.

**1.3.1 Administrative Responsibilities.** The primary responsibility for implementing the accident prevention plan shall be with the EDS Crew Chief. The Crew Chief must ensure that all EDS personnel are knowledgeable about the specific accident prevention measures designated. It will be the responsibility of each worker to implement the plan. Refer to section 2 for a breakdown of the project administration with respect to health and safety issues.

**1.3.2 Local Requirements.** All DPG requirements for safety and security will be followed. DPG-specific requirements will be covered during site training.

**1.3.3 Safety Training.** All EDS personnel will undergo site-specific and task-specific health and safety training.

**1.3.4 Hazard Marking.** Hazards will be marked according to the Army Regulation (AR) 385 series. The fence surrounding the EDS at DPG site will be posted with signs indicating that the area is restricted, dangerous, and unauthorized entry is illegal. Signs describing the conditions of entry will be posted at the gate to the EDS at DPG site.

Furthermore, the work site will be marked with appropriate chemical agent symbols. Other areas within the EDS at DPG site will be posted with signs appropriate to the hazards that may be present, such as hearing protection signs in areas subject to hazardous noise levels.

**1.3.5 Fire Protection/Emergencies.** Fire protection onsite shall be in accordance with 29 CFR 1910.155 through 165. Emergency procedures for fires and other disasters are included in section 10, Emergency Response and Contingency Actions.

**1.3.6 Inspections.** The Crew Chief shall conduct and document periodic safety inspections of the EDS at DPG site and equipment. All observed physical and chemical hazards not specifically addressed in the SHERP, which require corrective actions, will be documented. The daily log maintained onsite shall include daily reporting of treatment activities, site access, and site safety meetings.

**1.3.7 Housekeeping.** All areas within the work zone will be kept in a neat and orderly condition. Trash will be placed in a tightly sealed container or will be removed from the site at the end of each day's operation. Rubbish and debris will not be allowed to accumulate in or around the EDS at DPG site.

**1.3.8 Fire Lanes.** Designated access areas (fire lanes) surrounding the EDS site will be maintained at all times. EDS trailers must not block any roads, entrances, or exits from any buildings. Trailers and trucks must be parked with enough clearance for firefighting and other emergency equipment to access the area, if required.

**1.3.9 Accident Investigation Procedures.** Should an accident occur onsite, an accident investigation will be conducted in accordance with AR 385-10.

**1.3.10 Temporary Power Distribution.** Temporary power distribution systems must be installed by a qualified technician.

**1.3.11 Trailer Anchoring System.** All trailers will be anchored where required by local codes.

**1.3.12 Lockout/Tagout.** EDS workers must be protected from energy sources during maintenance activities by using lockout/tagout procedures that comply with OSHA regulation 29 CFR 1910.147. Guidelines are provided in **Appendix I-7**, *Lockout and Tagout Procedures for the EDS*. EDS personnel will follow Edgewood Chemical Biological Center (ECBC) procedures for lockout/tagout of the EE air filtration system for maintenance.

## SECTION 2

### HEALTH AND SAFETY ORGANIZATION AND ADMINISTRATION

The responsibilities of personnel involved in developing and implementing health and safety activities and procedures for EDS operations must be clearly defined for all involved organizations. Organizational responsibilities are shown in **Table I-2-1**. The safety and health organization chart is provided in **Figure I-2-1**. The following paragraphs describe health and safety responsibilities of the participating agencies.

The EDS System Operations Manager will have overall responsibility for safety and health of site workers. The EDS SHO will implement procedures described in this SHERP and other pertinent regulatory documents. Each worker is responsible for performing job tasks in a safe manner by abiding with requirements for wearing personal protective equipment (PPE) and following written procedures for operating equipment and performing other tasks. Each agency will ensure that their personnel are provided with the equipment and supplies needed for the safe performance of their assigned tasks.

The EDS SHO will have a reporting chain to the U.S. Army Chemical Materials Agency (CMA) Risk Management Directorate (RMD) that is independent of the supervisory chain, regardless of the organization actually providing the SHO. **Figure I-2-1** shows the safety and health organization for EDS at DPG operations.

Table I-2-1. Safety Responsibilities

Title	Responsibilities
PMNSCM, EDS System Operations Manager	<ul style="list-style-type: none"> <li>• SHERP review and concurrence</li> <li>• SHERP modification/deviation approval</li> <li>• SHERP preparation</li> <li>• Overall responsibility for site operation</li> <li>• Stop-action authority</li> </ul>
CMA, RMD	<ul style="list-style-type: none"> <li>• SHERP review and concurrence</li> <li>• SHERP modification/deviation concurrence</li> <li>• Conflict resolution</li> <li>• Recording and reporting accidents and injuries in accordance with Army and CMA policies</li> <li>• Stop-action authority</li> <li>• Pre-operational survey</li> <li>• Oversight</li> </ul>
DPG Chemical Agent Safety Specialist	<ul style="list-style-type: none"> <li>• DPG safety oversight</li> <li>• SHERP concurrence</li> </ul>
PMNSCM Field Office Manager	<ul style="list-style-type: none"> <li>• SHERP review and concurrence</li> </ul>
Industrial Hygiene Section	<ul style="list-style-type: none"> <li>• Modification/deviation approval during operations (of actions relating to industrial hygiene)</li> <li>• Health and safety inspections</li> <li>• Health hazard assessments</li> <li>• Stop-action authority</li> </ul>
Safety Engineer, ECBC	<ul style="list-style-type: none"> <li>• Implementation of team Safety Program</li> <li>• SHERP review and concurrence</li> <li>• SHERP modification/deviation concurrence</li> <li>• Operations and maintenance procedures review</li> <li>• Periodic safety audits and inspections as required</li> <li>• Reporting/recording accidents or injuries in accordance with Army policies and to CMA RMD</li> <li>• Stop-action authority</li> </ul>
EDS Crew Chief, ECBC	<ul style="list-style-type: none"> <li>• SHERP review</li> <li>• SHERP modification/deviation concurrence</li> <li>• SHERP implementation and enforcement</li> <li>• Accident prevention</li> <li>• Site safety training</li> <li>• Documentation/reporting (as required by SHERP)</li> <li>• Notification (as required by SHERP)</li> <li>• Site control</li> <li>• Stop-action authority</li> </ul>

Table I-2-1. Safety Responsibilities (Continued)

Title	Responsibilities
EDS SHO, ECBC	<ul style="list-style-type: none"> <li>• SHERP review</li> <li>• SHERP modification/deviation concurrence</li> <li>• SHERP compliance confirmation</li> <li>• Documentation/reporting (as required by SHERP)</li> <li>• Notification (as required by SHERP)</li> <li>• Safety inspections and audits</li> <li>• Site safety training</li> <li>• Accident prevention</li> <li>• Coordinate with site monitoring personnel</li> <li>• Stop-action authority</li> </ul>
Operations Personnel (All)	<ul style="list-style-type: none"> <li>• SHERP adherence</li> <li>• Accident prevention</li> <li>• Notification (as required by SHERP)</li> <li>• Stop-action authority</li> </ul>

Notes:

CMA	=	U.S. Army Chemical Materials Agency
DPG	=	Dugway Proving Ground
ECBC	=	Edgewood Chemical Biological Center
EDS	=	Explosive Destruction System
PMNSCM	=	Project Manager for Non-Stockpile Chemical Materiel
RMD	=	Risk Management Directorate
SHERP	=	Safety, Health, and Emergency Response Plan
SHO	=	Safety and Health Officer

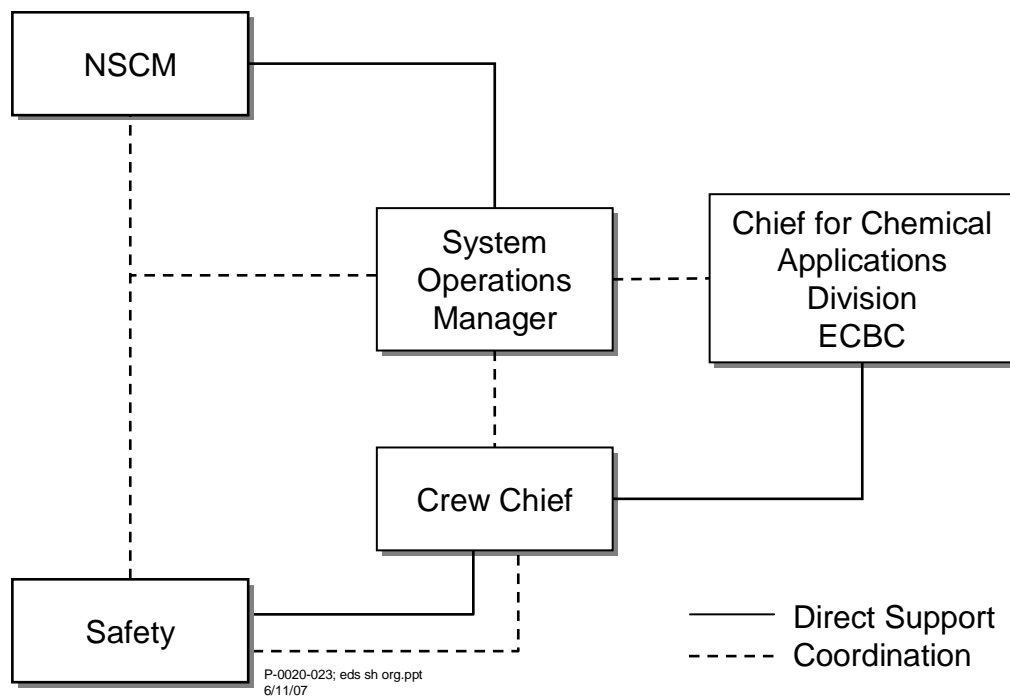


Figure I-2-1. EDS Safety and Health Organization

## SECTION 3

### TASK SAFETY AND HEALTH RISK ANALYSIS

This section addresses the potential health and safety hazards that may be encountered during EDS operations. Specific descriptions of the tasks will be provided in the Operations and Maintenance (O&M) Manual, Support Maintenance Manual, and the SOPs for EDS.

#### 3.1 Chemical Hazards

**3.1.1 Chemicals of Concern.** Chemical hazards are associated with the following items:

- a. Chemical warfare materiel (CWM):<sup>1</sup>
  - Distilled sulfur mustard (HD)
  - Thickened mustard (HT)
  - Sarin (GB)
  - Soman (GD)
  - O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate (VX).

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<sup>1</sup> The most current Materiel Assessment Review Board (MARB) assessments for the non-stockpile munitions indicate that the munitions are either possibly empty or not CWM. However, based on prior MARB assessments, which determined that some of the munitions contained GB, monitoring will be conducted for GB at all monitoring locations during EDS operations at DPG. Based on monitoring results if GB is detected, MEA (45 percent by volume) will be used as the treatment reagent.



b. Treatment reagent and solvents:<sup>2</sup>

- Monoethanolamine (MEA)
- Sodium hydroxide (NaOH)
- Hot water rinse.

c. The decontaminant for cleanup of spills is 5.25 percent sodium hypochlorite (household bleach).

d. The compressed gases and calibration standards used with the MINICAMS<sup>®</sup> are as follows:

(1) In compressed gas cylinders:

- Air (zero grade)
- Nitrogen
- Helium (also used for leak testing the Containment Vessel).

(2) In working standards and calibration vials:

- Dilute agent in hexane (research development, test, and evaluation [RDT&E] solution)

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<sup>2</sup> See footnote 1.

- Dilute agent in isopropanol (RDT&E solution)
  - Dilute agent in dichloromethane (RDT&E solution).
- e. A combination of linear-shaped charges (LSCs) and conical-shaped charges (CSCs) may be used to breach the item(s) and destroy the energetics.

The copper LSC is filled with a cyclonite (RDX)-based explosive and the copper-lined CSC is filled with a Composition A-3-based explosive.

The combined net explosive weight (NEW) of the munition and breaching charges will not exceed the approved NEW of the EDS Phase 2 Containment Vessel.

- f. Miscellaneous chemicals used to support EDS activities or for routine or occasional maintenance of the EDS equipment are included in **Table I-3-1**.

A list of the chemicals that require Material Safety Data Sheets (MSDSs) is located in **Appendix I-2** of this document. The Crew Chief will maintain a list of all chemicals used or handled at the site in the Command Post. This list will include any hazardous materials used for maintenance. MSDSs for all required chemicals will be maintained at the EDS Command Post and maintenance trailer.

**3.1.2 Exposure Pathways.** The following paragraphs describe the various exposure pathways through which contaminants can be introduced and the general precautions required to reduce the potential for human exposure. The EDS is designed to preclude exposure of personnel to hazardous chemicals. Site monitoring will determine the levels of airborne chemical concentrations that personnel may be exposed to during

Table I-3-1. Miscellaneous Chemicals Used to Support EDS

Material	Intended Use	Comment
Perma-Slik® Lubricant	Vessel sealing lubricant	Applied using a brush
Hydra Oil, Wanner (EPMD-F/G 20W or equivalent)	Lubricate supply pump	
Boelube	Lubricate valve fittings	
Conex Lubricant	Lubricate high voltage feedthroughs	
Grease Extreme Pressure (Mobilux EP#1)	Lubricate hinge support jack	
Loctite® N-7000 High Purity Anti-seize Lubricant	Lubricate vessel track	
TRACIT-300	Heat transfer cement for tank heaters	
Alcatel Leak Detector Oil	Lubricate leak detector	
Mobil DTE 629 Gear Oil	Used for tensioner pump	
Loctite® 242 Sealant	Used to secure nuts and bolts	
Transmission Fluid (Dextron II)	Used for trailer hydraulic system	
Pneumatic Lubricating Oil	Lubricate air-driven drum pump and double diaphragm air pump	
Acetic Acid (Vinegar)	Remove mineral deposit buildup in supply tanks and lines	Approximately 20 liters
Fluorolube Oil	Dampening the valve panel pressure gauge to eliminate erratic readings	
Fluorolube Grease	Lubricating the pressure gauge fittings	May be applied using a syringe
Helium Purity, Compressed, 99.99%	Vessel leak detecting and purge	
Mobil DTE 25 Hydraulic Oil	Hydraulic system and tensioner pump	
Detergent, General Purpose	General cleaning	
Grease, Multipurpose	Grease fittings and general areas not requiring specific grease	
Loctite® Sealant	Nut and bolts	
Oil, 10W30	Coleman Powermate Compressor	
Vacuum Grease, Dow Corning	Used to lubricate seals	
Vacuum Pump Fluid (oil)	Used for vacuum pump and leak detector	
WD-40® Aerosol	General purpose lubricant	

routine operations. A combination of near real-time (NRT) monitoring (for chemical agent) and Depot Area Air Monitoring System (DAAMS) will be used.

The exhaust from the waste drum carbon filter is vented through a flexible duct to the carbon filtered exhaust system. The exhaust filters combined are capable of exhausting at least 5,000 cubic feet per minute (cfm) of air volume to ensure adequate air flows within the EE.

- a. *Inhalation.* The inhalation of chemical vapors and mists is considered a significant means of potential exposure to the chemicals of concern. Workers will not routinely handle hazardous chemicals unless they are under engineering control or the workers are protected with respiratory protection. The potential for chemical exposure via inhalation will exist during spill situations and during sampling operations. The EE air filtration system is designed to prevent release of toxic materials to the atmosphere. Site monitoring and the use of respiratory protection is designed to prevent worker exposure above the published exposure limits during routine operations.
- b. *Dermal Contact.* Absorption through the skin from direct physical contact with chemical material is another potential means of exposure to the chemicals of concern involved in this project. PPE worn during loading, solid waste removal, and sampling tasks is resistant to the types of chemicals being handled. NRT low-level monitoring will be conducted to demonstrate that items transported outside the exclusion zone are not contaminated prior to leaving the EE. The EDS, in conjunction with appropriate PPE use and monitoring systems, will be used to control exposure via the dermal route.

- c. *Ingestion.* The potential for ingestion of contaminated media will be controlled through the use of good personal hygiene and by not allowing eating or drinking inside the exclusion zone or contamination reduction zone (CRZ).

The identification of chemical hazards is summarized in **Table I-3-2**.

### 3.2 Physical Hazards

Physical hazards associated with EDS operations pose an equal or greater potential for injury at this site than chemical exposure. Physical hazards can be posed by:

- Motorized equipment
- Heavy objects
- Excessive noise
- Biological hazards (for example, insects, toxic plants, rodents)
- Heat stress (see **Appendix I-5**)
- Cold Stress (see **Appendix I-6**)
- Tripping and falling hazards
- Thermal injuries
- Rotating machine parts
- Pinch points

Table I-3-2. Identification of Chemical Hazards

Process Stream/ Support Operation	Chemical Substances	Notation
Chemical Fill	Chemical agent	Items to be processed in the EDS are limited to chemical agent.
Explosive Charges:		The shaped charges may contain these explosives.
LSC	RDX	The LSC contains this explosive.
CSC	Composition A-3	The CSC contains this explosive.
EBW Detonators	PETN and RDX	The EBWs contain these explosives.
	Metals (aluminum, copper, lead)	A byproduct of the shaped charges
Chemical Treatment Reagents	MEA premixed with water	Provided in bulk drums or containers
	NaOH	Provided in bulk drums or containers
	Hot water rinse	Provided in bulk drums or containers
Air Monitoring/Laboratory Support	Air and nitrogen	Compressed gases used for operation of MINICAMS <sup>®</sup> and DAAMS tube analysis
	Chemical agent fills	Dilute agent solution in hexane for calibration, used with MINICAMS
Leak Detection/Calibration	Helium	Leak detector testing and vessel leak calibration
Routine and Occasional Support and Maintenance Activities	Lubricants, solvents, cleaners, Perma-Slik <sup>®</sup> lubricant, etc.	Perma-Slik lubricant is applied using a brush. Other materials, solvents, etc., are used on an as-needed basis (see <b>Table I-3-1</b> ).
Gaseous Emissions	Chemical fill material and LSC/CSC residual material	High levels of chemical fill material will exist in the Containment Vessel after the item is accessed; moderate levels of explosives may exist. After chemical treatment, low levels of airborne chemical fill material may be present in the vessel headspace above solid and liquid wastes.

Table I-3-2. Identification of Chemical Hazards (Continued)

Process Stream/ Support Operation	Chemical Substances	Notation
	Decomposition/reaction products Process reagents	Small amounts of carbon monoxide, nitrogen oxides, ammonia, and nitrogen may be produced from deactivation of energetic materiel. Trace levels of some VOCs may be produced during charge detonation and/or may be present when the vessel door is opened.
	He	Used to purge the EDS vessel
Liquid Waste	MEA/water/rinsewater	The post-treatment liquid waste stream will contain significant amounts of MEA.
	NaOH/water/rinsewater	The post-treatment liquid waste stream will contain significant amounts of NaOH.
	Spent sodium hypochlorite in water (bleach)	Used to decontaminate spills, used in PDS
	Chemical fill materiel	Before release, the liquid waste will be verified analytically.
	Explosives (Composition A-3 or RDX)	Although the treatment reagents are effective for explosives as well as the chemical fills, trace levels may remain.
	Metals (aluminum, copper, others)	Low levels of dissolved or suspended metals may exist from the item, the shaped charges, and the FSS.
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Some nitrogen- and sulfur-containing inorganics may be expected from energetic deactivation reactions.
Solid Waste	Chemical fill materiel	Although thoroughly treated to destroy the materiel, trace levels may remain.
	Explosives (Composition A-3 and RDX)	Although treatment reagents are also effective for explosives, trace levels may remain; particulates may remain if burster fails to explode.
	Metals (aluminum, copper, others)	Metal oxides are likely to be present as precipitates, as well as larger fragments of the item body or DOT cylinder.

Table I-3-2. Identification of Chemical Hazards (Continued)

Process Stream/ Support Operation	Chemical Substances	Notation
	Decontaminated metal parts and fragments	Munition casings, fragments, and components are composed of metal alloys and may contain TC metals. TC organics may be present as a result of mustard agent contamination.
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Some nitrogen- and sulfur-containing inorganics are likely to be present as precipitates formed from energetic deactivation reactions.

Notes:

CSC	=	conical-shaped charge
DAAMS	=	Depot Area Air Monitoring System
DOT	=	Department of Transportation
EBW	=	exploding bridge-wire
EDS	=	Explosive Destruction System
FSS	=	Fragment Suppression System
LSC	=	linear-shaped charge
MEA	=	monoethanolamine
NaOH	=	sodium hydroxide
PDS	=	Personnel Decontamination Station
PETN	=	pentaerythritol tetranitrate
RDX	=	cyclonite
TC	=	toxicity characteristic
VOC	=	volatile organic compound



- Electrical shock
- Compressed gas cylinders including compressed air systems
- Explosives
- Bloodborne pathogens
- Overhead hazards
- Fragmentation from explosion
- Unexploded components
- Fires and/or explosions
- Working at heights.

Injuries that may result from these physical hazards can range from slip-trip-fall types of accidents to casualties due to moving and/or rotating equipment. Injuries resulting from physical hazards can be avoided through the adoption of safe work practices and by employing caution when working with machinery.

To ensure a safe workplace, regular safety inspections are performed and documented. Safety inspections are conducted by the EDS Crew Chief or EDS SHO, or other team members who have been trained and qualified for the inspection. The Crew Chief will inform all site workers of any physical or chemical hazards related to each work zone. Daily health and safety briefings will be performed. The physical hazards and their preventive measures are discussed in the following paragraphs.

**3.2.1 Motorized Equipment.** Forklifts and trucks are among the types of motorized equipment that may be used onsite. This equipment can represent a hazard to workers. In general, requirements for motor vehicles and material handling equipment (MHE) are provided in the OSHA (U.S. Department of Labor) Safety and Health Regulations 29 CFR 1910 and Department of the Army (DA) policies. Specific requirements include:

- a. Vehicles may not have cracked windshields or windows.
- b. Forklift tines, dump bodies, and other hydraulic systems must be fully lowered when equipment is not in use.
- c. Parking brakes must be engaged when equipment is not in use.
- d. All lifting equipment must be inspected in accordance with U.S. Army Technical Bulletin (TB) 43-0142, *Safety Inspection and Testing of Lifting Devices*.
- e. Motorized equipment should have an audible alarm that sounds when it is operating in reverse. Where there are no audible alarms on existing equipment, the operator must use the horn to signal the intention to back up.
- f. All MHE must have a rollover protection system (ROPS) or a hard stand unless operating on flat terrain or within a building.
- g. Motorized equipment must be inspected by the operator prior to the beginning of each work shift. The Crew Chief must ensure compliance to this regulation. An inspection log will be maintained by the EDS Crew Chief.

General safety guidelines include:

- a. Ensure gas cylinders are secured properly when they are moved or stored, and during use. Gas cylinders will be located in an area where they can be easily secured (chained or otherwise kept from tipping over) or kept in a bottle rack. Cylinders not in use will be kept capped. All cylinders will be tagged to indicate status (for example, "In use," "Full," or "Empty"). Incompatible cylinders will be stored separately.
- b. Wear hard hats, safety shoes, leather work gloves, and other protective equipment when specified; for example, during setup or loading/unloading operations.
- c. Establish hand-signal communication when verbal communication is difficult. Designate one person per work group to give hand signals to vehicle operators.
- d. Only trained and certified personnel are to operate motorized equipment. Training documentation will be kept at Crew Chief's office/desk during operations.
- e. Avoid walking directly in back of, or to the side of, operating motorized equipment without the operator's knowledge.
- f. Ensure that no overhead power lines, telephone lines, or other utilities present a hazard in the work area. This requires marking and flagging all support wires for utility poles that are within the area used by a forklift or load-carrying vehicle.

**3.2.2 Heavy Objects.** Workers have mechanical equipment available to lift heavy objects. Workers will be trained in proper lifting techniques in order to avoid personal injury and will have received specific training addressing the use of MHE. Two examples of heavy objects onsite are waste drum handling and final assembly of the FSS. Operators must utilize MHE when transporting or moving waste drums, if necessary. During final assembly, the cylinder top (150 pounds) is lifted approximately 47.5 inches from the decking to complete the FSS. Double the weight limits (56 pounds) shall be used as the maximum values in determining the two person lifting, provided the load is uniformly distributed between the two lifters. Where three or more persons are lifting simultaneously, not more than 75 percent of the one person value may be added for each additional lifter, in accordance with Military Standard (MIL-STD) 1472.

*3.2.2.1 Safety Inspection and Testing of Lifting Devices.* Lifting devices are used to raise, lower, hold, or position a load from one location or elevation to another. Lifting devices include, but are not limited to: forklift trucks, cranes, manual or motorized pallet jacks, hoists, wreckers, A-frames, slings, ropes, wire ropes, hooks, O-rings, pear rings, spreader bars or lifting clamps, beams, jacks, safety stands, chains and jack stands. Before a lifting device can be used, it must have a current rated load test and the rating must exceed the weight of the material/item to be moved. All new lifting devices will either have a certified manufacturer's load test rating or the using organization will have to arrange for a load test prior to the new lifting device being used. The lifting devices will be marked with the load test rating and the date the test was conducted. After entering into service, lifting devices will be inspected and load tested periodically as prescribed in OSHA and Army regulations. Prior to conducting operations, the lifting device will be inspected and daily inspections will be conducted during the course of the operation thereafter. Maintenance and inspection records for each lifting device will be maintained for verification.

**3.2.3 Excessive Noise.** Workers are protected from exposure to excessive noise through equipment design. Workers are enrolled in hearing conservation programs that comply with 29 CFR 1910.95 and AR 40-5, *Preventive Medicine*. If noise levels are below the OSHA action levels, workers do not need to be enrolled in the hearing conservation programs. If appropriate, a noise survey will be conducted to identify noise hazard areas. The following are indicators that a noise survey may be necessary:

- Workers report tinnitus for various periods of time after they leave the workplace.
- Workers have difficulty communicating unless they yell at one another.
- When workers leave after an 8-hour day, they have difficulty hearing and understanding speech.

However, the necessity for a noise survey is not limited to the previously listed indicators.

**3.2.4 Biological.** Biological hazards include poisonous plants as well as biting and stinging arthropods (such as spiders), reptiles (such as snakes), and mammals. To eliminate or discourage these types of plants and animals in the work area, site preparation includes creating walkways to the site. Brush and debris will be kept away from the site, both as a fire prevention measure and to eliminate pest breeding and nesting areas. Waste receptacles will have tight-fitting lids or will be emptied daily of trash so as not to serve as a potential food source for animal life. Potential exposure to biological hazards is expected to be minimal since most workstations are inside the EE or in the Command Post.

Flying insects such as mosquitoes, wasps, hornets, and bees may be encountered. Starting in spring, and continuing throughout the summer, site safety personnel will

inspect buildings and outdoor equipment for nests. If an aboveground nest such as a wasp nest is found, it may be destroyed by onsite personnel using a contact poison, after which the nest will be destroyed.

Mosquito breeding sites include empty containers and shallow depressions. The EDS at DPG site will be kept clear of empty cans and other trash that could collect water and provide mosquito breeding sites. If standing water is noted in any part of the EDS site for more than 2 days after a summer rain, the spot will be filled in or drained. If necessary, a work order will be submitted to have the appropriate organization perform the work. If it is decided to drain the area by digging a ditch, steps will be taken to ensure that the ditch does not create a tripping or falling hazard and that the ditch does not compromise site security. Personnel are encouraged to use spray repellent and the appropriate level of dress (for example, long pants and long-sleeved shirts) to avoid exposure.

Persons who are allergic to insect stings or bites, or who may require medical attention after exposure to poisonous plants such as poison ivy, will notify the System Operations Manager or SHO in writing before starting work on the project.

**3.2.5 Heat Stress.** Wearing PPE can increase the risk of a worker developing heat stress. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and individual characteristics of the worker. Heat stress is one of the most common and potentially serious illnesses at hazardous sites. Regular monitoring and other precautions are vital.

Heat stress hygiene practices are particularly important because they reduce the risk that an individual may suffer a heat-related disorder. The key elements are fluid replacement, self-determination of exposures, health status monitoring, maintenance of a healthy life-style, and adjustment of expectations based on acclimatization state.

The government will ensure that adequate potable water or other re-hydration beverages are available to workers conducting heat stressful operations to protect such workers from heat-related injuries. Each Commander and Site Project Manager is requested to verify that their site safety and health plans confirm to the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations and meet the requirements in OSHA [29 USC 655], Section 6, 1970; OSHA HAZWOPER Regulation, 29 CFR 1910.120(p)(1), 1989 (amended 2006); and 29 CFR 1960.1(a), 1980 (amended 1995).

Personnel working within the exclusion zone will be wearing PPE (see section 6 for PPE requirements). Workers will be closely observed for heat stress.

The monitoring methods, symptoms, and preventive measures for heat stress for the use of non-permeable clothing are provided in **Appendices I-5-1** and **I-5-2**. The monitoring methods, symptoms, and preventive measure for heat stress for the use of Chemical Protective Clothing Level B and higher are provided in **Appendix I-5-3**.

**3.2.6 Cold Stress.** If the body has a poor physiological response to cold weather work, a number of adverse health effects can occur. These may include hypothermia, frostbite, frostnip, and trench/immersion foot.

The monitoring methods, symptoms, and preventive measures for cold stress are provided in **Appendix I-6**.

**3.2.7 Tripping and Falling Hazards.** Workers will be apprised of potential tripping hazards through the daily health and safety briefings conducted by the Crew Chief and SHO. Whenever possible, trip and fall hazards have been eliminated or are clearly marked.

The work platform on the EDS trailer is approximately 37 inches above the ground. Falling from this height could cause injury. A 4.5-foot safety rail surrounds the trailer working area.

**3.2.8 Thermal Injuries.** Thermal injuries can occur when excessively hot items are being handled. These items may include the vessel and tank heaters, and MINICAMS halogen selective detectors. These items will be labeled “HOT.”

The vessel is heated to temperatures between 50° to 100°C (122° to 212°F) using external heaters with surface temperatures of 400°F. The heaters are well-insulated and the surface temperature of exposed vessel surfaces should not present a serious burn potential.

**3.2.9 Rotating Machine Parts.** Pieces of mechanical equipment with rotating parts should have guards to prevent contact and should not be operated with guards removed. Watches, jewelry, and other loosely hanging articles must be removed prior to working around rotating machine parts.

The EDS vessel rotates via an electric gear drive. If the vessel were activated inadvertently, personnel could potentially have contact with rotating machine parts. This hazard is controlled by the EDS Crew Chief physically controlling the interlock key and ensuring that all personnel are clear (accounted for) of the vessel prior to activating the electric gear drive. Should personnel need to work on or near the vessel when it is rotating, an EDS Crew Chief or other trained EDS operator must accompany them. The trained EDS operator will stop rotation of the vessel and remove the interlock key.

**3.2.10 Pinch Points.** In addition to pinching and crushing hazards caused by moving parts, pinching and crushing hazards also are present when handling heavy items or when around moving vehicles and MHE. A pinch point (that is, sharp edges, FSS, and loosening and tightening hydraulic nuts) is any place where a body part can be caught



between two or more moving parts. Fingers, hands, and feet can be caught directly in pinch points, or they may be drawn into the pinch points by loose clothing that becomes entangled. All personnel must wear leather gloves at all times when working around pinch points. Safety shoes, hard hats, and work gloves will be worn as required by the SOP.

**3.2.11 Electrical Shock Hazards.** All EDS electrical wiring was installed according to the National Electrical Code (NEC), and the electrical equipment meets NEC standards. Electrical shock hazards may exist during equipment failure. All maintenance activities will be conducted following 29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*. Electrical shock hazards will be minimized by use of the Lockout/Tagout Program.

**3.2.12 Compressed Gas Cylinders.** Compressed gas cylinders will be properly sorted, handled, transported, and labeled to clearly identify the gas contained. They also will have tags to indicate when the cylinder is empty or in use. All personnel who handle and/or use compressed gas cylinders must be trained in recognizing and identifying characteristics of the various gas products and the proper methods of safely handling full and empty cylinders.

- a. During storage, compressed gas cylinders must be protected from heat sources such as intense radiant heat, electric arcs, and high-temperature lines. Compressed gas cylinders will not be exposed to temperatures exceeding 125°F. The storage area must also protect the cylinders from passing or falling objects, as well as unauthorized tampering. Storage must also prevent the cylinders from tipping, falling, and rolling.
- b. Workers must be sure to close off the valves before moving cylinders, at the end of each job, and when cylinders are empty. Cylinders will not be rolled, dragged, or slid; however, only one cylinder at a time may be tilted

or rolled within the confines of the EE. Whenever practical, a hand truck or other similar device capable of securing the cylinder will be used. Valve protection caps must be placed on cylinders when they are not in use or being moved. A periodic check, conducted daily, should include an inspection of the cylinder bottom.

- c. During transportation, cylinders will be secured to the vehicle to prevent the cylinders from tipping, falling over, and rolling.

**3.2.13 Compressed Air Systems.** Compressed air systems must be operated according to manufacturer's specifications within the maximum allowable pressure for the application. Equipment (for example, air compressors) must have a pressure rating. Operators must monitor the system to ensure the operating pressure is not exceeded.

Air guns that use compressed air for cleaning must be pressure-reduced down to a maximum of 30 pounds per square inch gauge (psig) for use during EDS operations. Operators must wear eye protection at all times when using compressed air for cleaning purposes.

**3.2.14 Explosives.** The munitions that will be brought to the EDS site at DPG have been x-rayed to evaluate the status of the explosive components. Only trained munitions handlers will handle the munitions in accordance with U.S. Army Materiel Command Regulation 350-4 and AR 50-6. In addition, items will be moved as few times as possible and will be lifted no higher than necessary when being moved. The normal lift restriction is 3 feet. This may be exceeded under certain circumstances such as loading or unloading a transport vehicle from ground level. The SHO will approve such deviations.

**3.2.15 Bloodborne Pathogens.** Due to the inherent risks associated with working with metal barrels, awareness to the OSHA standard on bloodborne pathogens is critical.

OSHA 29 CFR 1910.1030 (Bloodborne Pathogen Standard) will apply to the job tasks assigned to employees working at the EDS site at DPG. Employees are trained in aiding fellow employees in the event of a health emergency so implementation of a Bloodborne Pathogen Control Plan is required. The route of exposure expected for the EDS site at DPG would be parenteral in nature (cut or skin piercing). All bloodborne pathogen spills will be treated with the assumption that all blood and other bodily fluids released are contaminated. This is called taking "universal precautions."

Work practices will be developed to ensure that employees assisting injured employees do not come into direct contact with blood or bodily fluids. This can be accomplished by wearing the proper PPE described in the procedure for bloodborne pathogen spill cleanup. Controls will be put in place, or the tasks altered to reduce the likelihood of exposure. Immediate decontamination of all work surfaces (with the specified reagent) that might be contaminated with the blood product is required. A bloodborne pathogen cleanup kit will be available onsite.

All blood-contaminated items are considered regulated wastes and must be decontaminated and/or disposed of properly. Any non-disposable PPE that has been contaminated with blood must be separated from normally laundered PPE. This is to protect laundry workers from bloodborne pathogen exposure. PPE that is contaminated with blood will be placed in appropriate containers that are labeled as BIOHAZARD per OSHA 1910.1030 (g)(1) and disposed of in accordance with all Federal, State, and local regulations. Non-reusable clothing and spill supplies must be handled as regulated medical waste and disposed of through the proper medical waste disposal site.

Training records must be preserved for a minimum of 3 years. Annual training is required for all affected employees. Medical records will be stored according to the standard.

**3.2.16 Overhead Hazards.** Overhead hazards are of two types, bumping/low clearance areas and material/items falling from overhead. To prevent injury from low clearance areas, hard hats will be worn in all areas that are low clearance. Hard hats will also be worn in all areas where there is a potential for items to be dropped or fall from overhead.

Under no circumstances shall anyone stand or pass through any area below an elevated load. Elevated loads include anything being supported by such items as forklifts or cranes. Items that have been either permanently or semi-permanently fixed with supports are not considered elevated loads.

**3.2.17 Fragmentation from Explosion.** It is possible that a munition could detonate if dropped while it is being prepared for placement into the EDS. Fragments from that explosion could cause injury or death of nearby workers. Only Explosive Ordnance Disposal trained personnel will handle munitions and explosives. An explosive hazard area has been identified and non-essential personnel will be excluded from that area when munitions or explosives are being handled.

**3.2.18 Unexploded Components.** After detonation and treatment, there remains the potential for unexploded components or fuses inside the Containment Vessel. These must be recognized so that appropriate actions can be taken. To ensure that these items are recognized and handled properly, EDS explosive operator(s) will perform a survey of the contaminated vessel upon its opening. If any unexploded components or fuses are detected, they will then take appropriate follow-up action.

**3.2.19 Fires and/or Explosions.** Fires and/or explosions may be ignited by lightning, improper location of flammable materials, electrical equipment malfunction, or other heat source in the vicinity of the EDS site. Two fire extinguishers containing ten pounds of extinguishing chemicals or higher for flammable or combustible liquid fires (Class B fire) and electrical fires (Class C fire) will be readily available. In accordance with

Department of the Army Pamphlet (DA Pam) 385-64, fire extinguishers need to be permanently located at the site; however, each extinguisher will be placed in a conspicuous and readily available location.

**3.2.20 Working at Heights.** All operations from which there is a drop of more than 4 feet shall be guarded by rail, picket fence, half door, or equivalent barrier. Barrier design criteria are established in OSHA regulation 29 CFR 1910.23. Where barriers are not feasible for work at elevated heights (greater than 4 feet) fall protection equipment shall be used. Ladders under 20 feet are exempted from these requirements.

PPE requirements for fall protection vary depending upon tasks being conducted. Since limited elevated work activities occur onsite, PPE requirements are established based upon specific tasks. If tasks are not identified in the following list, all individuals who will be working at an elevated height shall receive prior approval of work setup from the EDS Crew Chief and/or EDS SHO.

- *Scaffolding.* Each worker must be protected by a Type 1 full-body harness attached to a shock absorbing lanyard. The lanyard must not exceed 6 feet in length and shall be securely attached to substantial members of the structure (not the scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall.
- *Elevated Work Platforms.* Each worker must be protected by a Type 1 full-body harness attached to a shock absorbing lanyard. The lanyard must not exceed 6 feet in length and shall be securely attached to substantial members of the platform, which will safely suspend the worker in case of a fall. Fall protection equipment must meet design requirements specified in Appendix C, Section I of OSHA regulation 29 CFR 1910.66.

Components of fall protection equipment must be inspected prior to each use. If, upon inspection, a piece of equipment displays any signs of wear, that item should be withdrawn from service immediately.

- *Ladders.* When ladders are improperly selected, used, and maintained, they can pose a fall hazard. Prior to use of a ladder, all employees shall inspect the equipment for defects such as missing cleats, cracked rungs, broken spreaders, or splinters. Defective ladders must be removed from service and tagged or marked: "Dangerous, Do Not Use." Ladders should be stored where they will not be exposed to the weather or stored near radiators, steam pipes, or in places subjected to excessive heat or dampness. Requirements to minimize and eliminate such hazards are as follows:
  - Only use Type I industrial stepladders of an appropriate length. Do not use makeshift ladders or platforms, such as boxes, barrels, or chairs. Do not place ladders on any articles for additional height.
  - Straight and extension ladders shall have grippers or cleats (safety feet).
  - DO NOT select metal ladders when working on or near electrical equipment.
  - The distance from the bottom of a straight ladder to its support wall shall be one-quarter the working length of the ladder.
  - Set up ladders on a firm level surface.

- Whenever feasible, straight ladders shall be secured with a rope or wire at the top and blocked at the bottom.
- The two highest steps and top platform shall not be used for climbing.
- If a straight ladder is used to climb onto an elevated work station, it shall extend at least 3-1/2 feet above the working level.
- Do not over-reach, jump, or slide a ladder while on it. Move the ladder as work progresses.
- Always face the ladder and use both hands while ascending or descending.
- Tools or materials should be raised by means of a rope after the climber has reached the working position.
- Barricades and warning signs should be posted when ladders are placed near doors or other locations where they could be struck.
- Two personnel shall handle and set up all extension ladders.
- Ladders shall not be used by more than one person at a time.

### **3.3 Waste Management**

All solid and liquid wastes generated during EDS operations will be collected in Department of Transportation (DOT)-approved containers, characterized, and managed in accordance with Federal, State, and local regulations and DPG procedures.

Resource Conservation and Recovery Act (RCRA) characterization for hazardous waste will be based on process knowledge, MSDSs, and chemical and physical analysis obtained during previous EDS operations at DPG and Dover Air Force Base. Agent screening will be performed onsite by ECBC.

### **3.4 Assessment of Health Hazard Issues**

**3.4.1 Toxic and/or Combustible Chemical Substances.** The chemicals identified in **Table I-3-2** as potential health hazards are assessed in **Table I-3-3**. The table contains summary exposure assessments and hazard assessments for each potential exposure pathway for each chemical or class of chemicals.

The ingestion pathway is assumed to present a slight risk and is not assessed further. The consideration of the inhalation and dermal exposure routes is deemed sufficient for this assessment.

### **3.5 Recommendations**

**3.5.1 Toxic and/or Combustible Chemical Substances.** Recommendations are presented in **Table I-3-3** for controlling the hazards presented by potential exposure to toxic and/or combustible chemicals.

**3.5.2 Heat.** Monitor ambient temperature within the EDS work area and adhere to maximum wear times and protocol established by the American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs), **Appendix I-5-1**.



**3.5.3 Noise.** If monitoring performed in accordance with paragraph 3.2.3 of this plan reveals sound levels greater than the OSHA action level of 85 decibels using the A-weighted scale with slow meter response dB(A), the EDS Crew Chief will ensure appropriate selection and use of hearing protection.

Table I-3-3. Assessment of Hazards

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Handling Munition	Chemical agent fills	Dermal – Exposure may occur if item is leaking or is mishandled.	Dermal – Skin contact with some agents may cause severe injury.	SOP Personal Protective Equipment – see <b>Table I-6-1</b> of this SHERP
		Inhalation – Exposure may occur if item is leaking or is mishandled.	Inhalation – Exposure to some airborne agents may cause death even after short exposure.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>
	Explosive compounds (RDX or Composition A-3, TNT, tetryl, black powder)	Dermal – Exposure may occur if munition explosive compounds are directly contacted.	Dermal – Negligible hazard due to short contact period	Administrative – Minimize handling time
		Inhalation – Limited exposure may occur if munition explosive compounds are directly contacted.	Inhalation – Negligible hazard due to short exposure period and relatively low airborne levels anticipated	Administrative – Minimize handling time
Sampling Containment Vessel Vapors	Chemical agents	Dermal – Although vapor sample is drawn remotely, skin exposure to small amount of vapor or condensate may occur when retrieving sample bottle.	Dermal – Minor bodily injury is possible if certain agents (blister agents and those that are severe irritants) contact the skin, even at low quantities.	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Low-level exposure may occur due to leakage of the sample bottle seals or leakage of other vessel seals into the work area.	Inhalation – Although safeguards (air monitoring, personal protective equipment, engineering design, etc.) are in place to prevent personnel exposure to elevated levels (above worker exposure limits) of airborne agents, it is assumed that exposure to low levels may cause minor bodily injury.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>

Table I-3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sampling Containment Vessel Vapors (Continued)	Explosives (RDX or Composition A-3)	Dermal – Skin exposure to very small quantities may occur when retrieving sample.	Dermal – Hazard expected to be negligible due to short exposure time and very small quantities expected	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Very low-level exposure may occur due to leakage of sample bottle seals or leakage of other vessel seals.	Inhalation – Hazard expected to be negligible due to limited exposure time and very low level of airborne contaminants expected	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>
	Decomposition products from explosion (ammonia, nitrogen oxide, nitrogen, VOCs)	Dermal – Exposure to extremely small quantities may occur.	Dermal – No hazard due to limited exposure period and lack of toxicity of products via skin contact/absorption	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Very low-level exposure may occur due to leakage of sample bottle seals or leakage of other vessel seals.	Inhalation – Hazard expected to be negligible due to limited exposure time and very low level of airborne contaminants expected	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>
Reagent Transfer Operations	Reagents (MEA, NaOH, solvents, etc.)	Dermal – Limited exposure may be expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – As strong skin and eye irritants, severe injury may occur with significant exposure	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Limited exposure will occur frequently, and significant exposure may occur at some point in operations.	Inhalation – As respiratory irritants, short-term exposure may cause minor injury	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>

Table I-3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sealing EDS Vessel	Sealants/degreasers (Perma-Slik <sup>®</sup> lubricant)	Dermal – Exposure to extremely small quantities may occur.	Dermal – No hazard due to limited exposure period and low-order toxicity on the unprotected skin	Administrative – Minimize sealing time Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Exposure may occur.	Inhalation – Short-term exposure may cause minor injury.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>
Sampling Liquid Treatment Waste and Handling Liquid Waste Drums	Treatment reagents (MEA and NaOH)	Dermal – Limited exposure may be expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – As strong skin and eye irritants, severe injury may occur with significant exposure.	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Limited exposure will occur frequently, and significant exposure may occur at some point in operations.	Inhalation – As respiratory irritants, short-term exposure may cause minor injury.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>
	Chemical fill materiel	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible since presence of agent will be verified prior to transferring to waste drum.	Administrative – Minimize sampling time Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Inhalation – Hazard is negligible since presence of agent will be verified prior to transferring to waste drum.	Administrative – Minimize sampling time Personal Protective Equipment – see <b>Table I-6-1</b>

Table I-3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sampling Liquid Treatment Waste and Handling Liquid Waste Drums (Continued)	Explosives (RDX and Composition A-3)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in solution.	Administrative – Minimize sampling time
		Inhalation – No exposure anticipated.	Inhalation – No hazard	Not applicable
	Metals (aluminum, copper, others)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in solution.	Administrative – Minimize sampling time
		Inhalation – No exposure anticipated.	Inhalation – No hazard	Not applicable
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in solution.	Administrative – Minimize sampling time
		Inhalation – No exposure anticipated.	Inhalation – No hazard	Not applicable
Sampling Solid Waste and Removal from Containment Vessel	Chemical fill materiel	Dermal – Limited exposure expected to occur frequently.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated to be remaining in waste.	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Limited exposure expected to occur frequently.	Inhalation – Hazard is negligible since presence of agent will be verified prior to transferring to waste drum.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>

Table I-3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sampling Solid Waste and Removal from Containment Vessel (Continued)	Explosives (RDX and Composition A-3)	Dermal – Limited exposure expected to occur frequently.	Dermal – Hazard is negligible due to short exposure period and very low levels anticipated to be remaining in waste.	Administrative – Minimize sampling time
		Inhalation – No exposure anticipated.	Inhalation – No hazard	Not applicable
	Metals (aluminum, copper, others)	Dermal – Limited exposure expected to occur frequently.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in waste.	Administrative – Minimize sampling time
		Inhalation – No exposure anticipated.	Inhalation – No hazard	Not applicable
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Dermal – Limited exposure expected to occur frequently.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in waste.	Administrative – Minimize sampling time
		Inhalation – No exposure anticipated.	Inhalation – No hazard	Not applicable
Monitoring Support Operations	Compressed gases for MINICAMS <sup>®</sup> (or other equivalent instrumentation) operation (hydrogen, air, nitrogen)	Dermal – Possible exposure to high-pressure leak from line	Dermal – Hazard is negligible since gases are not toxic via skin contact/absorption and leak would not have enough force to cut skin.	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Exposure to leak likely to occur at some point in operations.	Inhalation – Negligible hazard since gases are non-toxic and are not expected to cause IDLH atmospheres in ventilated room.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>

Table I-3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Monitoring Support Operations (Continued)	Dilute RDT&E Agent Solutions	Dermal – Likely to occur	Dermal – Minor injury may result due to exposure to dilute agent quantities, or limited contact time.	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Exposure is unlikely.	Inhalation – No hazard	Not applicable
Routine and Occasional Support and Maintenance Activities	Lubricants, solvents, cleaners, etc. (See <b>Table I-3-1</b> for complete list.)	Dermal – Exposure to extremely small quantities may occur.	Dermal – Minor injury (dermatitis) may occur.	SOP Personal Protective Equipment – see <b>Table I-6-1</b>
		Inhalation – Exposure may occur.	Inhalation – As respiratory irritants, short-term exposure may cause minor injury.	Engineering Control – Filter/mechanical ventilation SOP Personal Protective Equipment – see <b>Table I-6-1</b>

Notes:

EDS = Explosive Destruction System  
IDLH = immediately dangerous to life and health  
MEA = monoethanolamine  
RDT&E = research, development, test, and evaluation  
RDX = cyclonite  
SHERP = Safety, Health, and Emergency Response Plan  
SOP = Standing Operating Procedure  
TNT = trinitrotoluene  
VOC = volatile organic compound

## **SECTION 4**

### **TRAINING**

#### **4.1 Offsite Training**

All EDS at DPG operations personnel will be certified to meet the minimum training requirements outlined in OSHA standard 29 CFR 1910.120 covering Hazardous Waste Operations and Emergency Response. The Crew Chief will maintain the certification records for EDS operations team personnel onsite. Training records and verifications for EDS personnel will be maintained onsite and will be readily available upon request. These requirements specify that employees must have completed:

- a. Forty hours of initial training, consisting of classroom and hands-on experience in the use of PPE, safe operating procedures, identification of potential hazards or hazardous situations, emergency response training, etc., in accordance with the OSHA standard; or 24 hours of training for workers onsite for specific tasks (auditors, etc.)
- b. Eight hours of annual refresher training in addition to the initial 40- or 24-hour training program for all personnel
- c. Eight hours of specialized supervisory training for personnel serving as supervisory staff
- d. Three days of work activity under the supervision of a trained and experienced supervisor for new employees



- e. First-aid and cardiopulmonary resuscitation (CPR) training for responders
- f. Hazardous waste operations.

A letter signed by the designated contractor representative certifying dates of training and medical surveillance physicals for contract personnel will be furnished in lieu of actual training records. Copies of training records for other personnel will be maintained onsite.

## **4.2 EDS-Specific Training**

**4.2.1 EDS Personnel.** All EDS personnel will receive training specific to operations and the tasks they are expected to perform, as shown in **Table I-4-1**.

**4.2.2 EDS Site Visitors, Inspectors, and Non-routine Workers.** During EDS site operations, personnel may be present who will not actively or routinely engage in hazardous waste treatment or handling operations. These personnel may be visitors, such as regulatory agency inspectors; Chemical Weapons Convention (CWC) inspectors/observers; independent contractor data collectors/observers/inspectors; and non-routine workers such as electricians and engineers to repair equipment or perform structure repairs. These types of personnel will, at a minimum, receive a briefing on site-specific hazards. Any required training for PPE must be documented. In addition, these personnel may also attend a daily safety briefing as applicable and other training on the EDS and its operation, depending on the level of participation or work activity to be conducted.

Visitor authorization must be obtained from the EDS Site Manager or Crew Chief prior to site visit. Visitors to the site will be escorted at all times.

Table I-4-1. Training Requirements of EDS Workers<sup>a</sup>

	Job Description							
	Visitors	Non-routine Workers	EDS System Operations Manager	EDS Crew Leader	Site Safety and Health Officer	EDS Crew Chief	Chemical Operator	Explosives Operator
<b>Compliance Training</b>								
CPR/First Aid <sup>b</sup>					X	X	X	X
HAZCOM (OSHA 1910.1200) <sup>c</sup>		X	X	X	X	X	X	X
HAZWOPER (OSHA 1910.120) <sup>d</sup>		X	X	X	X	X	X	X
HAZWOPER Supervisor (8-hour OSHA 1910.120)			X			X		
Bloodborne Pathogens <sup>e</sup>			X	X	X	X	X	X
Lockout/Tagout <sup>f</sup>			X	X	X	X	X	X
Hearing Conservation			X	X	X	X	X	X
Respiratory Protection			X	X	X	X	X	X
<b>Site Orientation</b>	X	X	X	X	X	X	X	X
<b>Operator Training<sup>g</sup></b>								
EDS Operating Systems (trailer, vessel, hydraulic systems, reagent supply system, electrical systems, helium leak detection, waste transfer system)						X	X	X
EDS Setup						X	X	X
Manage and Process Hazardous Waste						X	X	X
Munition Processing						X	X	X

Table I-4-1. Training Requirements of EDS Workers<sup>a</sup> (Continued)

	Job Description							
	Visitors	Non-routine Workers	EDS System Operations Manager	EDS Crew Leader	Site Safety and Health Officer	EDS Crew Chief	Chemical Operator	Explosives Operator
Chemically Treat Fill						X	X	
Other-Than-Normal Operations						X	X	X
Final Shutdown and Closeout						X	X	X
Preparation for EDS Movement						X	X	X

Notes:

- <sup>a</sup> Actual training requirements will depend on the existing skill level for each individual who may have already had equivalent training and experience, and will be based on a job task analysis.
- <sup>b</sup> Annual recertification for CPR required and recertification for first aid every 3 years
- <sup>c</sup> Initial training is required before working with hazardous chemicals; refresher training is needed whenever the hazard changes.
- <sup>d</sup> Annual 8-hour refresher required.
- <sup>e</sup> Annual training required.
- <sup>f</sup> Training must be conducted initially and must reoccur as necessary.
- <sup>g</sup> Annual refresher training to address system changes, SOP changes, etc.

CPR = cardiopulmonary resuscitation  
EDS = Explosive Destruction System  
HAZCOM = hazard communication  
HAZWOPER = Hazardous Waste Operations and Emergency Response  
OSHA = Occupational Safety and Health Administration

### **4.3 Site-Specific Training**

DPG requires site-specific training to be conducted prior to entrance into certain areas of the installation (for example, a toxic aid briefing). All EDS operations personnel working on the site will attend training as required. This training will be documented in accordance with site policies.

Prior to startup of EDS activities, a pre-work briefing will be presented to all personnel by the Crew Chief/SHO. The following topics will be addressed during the pre-work briefing:

- a. Names of personnel and alternates responsible for site health and safety
- b. Safety, health, and other hazards present onsite as documented in the site-specific SHERP, as well as additional hazards, if any, found during the site activities
- c. Use of site-specific PPE
- d. Work practices that will minimize risks from hazards and exposure
- e. Safe use of engineering controls and equipment that are present on the site
- f. Physical and chemical health hazards, including recognition of symptoms and signs that may indicate overexposure to such hazards
- g. Emergency response/contingency plans, including notification process and routes of escape

- h. Importance of “buddy system”
- i. Any other site-specific features, as deemed necessary
- j. Inspection of all power equipment at the start of each day
- k. Use of site safety equipment such as fire extinguishers.

Any other health- and safety-related topics that may arise prior to startup also will be discussed at the pre-work briefing. Issues that may arise during implementation of the field program will be addressed during safety meetings, which are to be held daily, prior to shift startup. Any changes in procedures or site-specific health- and safety-related matters will be addressed during these meetings.

## SECTION 5

### MEDICAL SURVEILLANCE

#### 5.1 Health Monitoring

All personnel involved in EDS activities will participate in a comprehensive health-monitoring program as required by AR 40-5, *Preventive Medicine*, and OSHA 29 CFR 1910.120(f). The medical surveillance program shall be developed based on specific needs, location, and potential exposure of workers at the work site. The program will include pre-placement, periodic, and termination physical examinations. Medical surveillance for EDS operations will comply with the requirements of DA Pam 40-8, DA Pam 40-173, DA Pam 385-61, and *Implementation Guidance Policy for Revised Exposure Limits for GB, GA, GD, GF, VX, H, HD, and HT* (DA, 2004).

Contractor personnel involved in EDS operations are required to be enrolled in a corporate medical surveillance program, as required by OSHA 29 CFR 1910.120(f).

**5.1.1 Initial Medical Monitoring.** The initial screening of all U.S. Army personnel will be performed in accordance with AR 40-5. The screening will include a physical examination to determine the worker's ability to wear protective clothing, including air-purifying respirators (APRs).

As a minimum, the following initial medical screening is required:

- Occupational history
- Medical history

- Physical exam
- Clearance for respiratory protection.

**5.1.2 Periodic Monitoring.** Periodic monitoring will include annual updates based on exposure information obtained during the intervening year. If no exposures at or above established exposure limits have taken place, periodic physicals will be performed as determined by the physician. More frequent examinations will occur if determined necessary. As new exposure hazards are identified, the baseline health hazard inventory will be expanded, and the content of the medical surveillance examinations will be appropriately modified. The site monitoring lead will provide any monitoring records to appropriate Army and contractor safety offices for any employee exposed to chemical material.

**5.1.3 Specific Monitoring.** If any worker develops signs or symptoms indicating possible exposure to hazardous substances or health hazards, or is injured, medical examinations and consultations shall be made according to the following schedules:

- a. As soon as possible following an injury or development of signs or symptoms
- b. At times when an examining physician or certified industrial hygienist determines a worker is at risk due to overexposure
- c. At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

**5.1.4 Project Completion Examination.** EDS workers will be medically examined at the termination of their employment or the reassignment to an area where the employee

would not be covered by medical monitoring requirements if the worker has not had an examination within the last 6 months.

## **5.2 Documentation and Recordkeeping Requirements**

At the EDS site, the Crew Chief will maintain a current chemical duty position roster noting personnel who are certified EDS operators. Personnel listed on this roster are certified as currently meeting medical training and medical surveillance requirements. Copies of required medical clearances and training records shall be kept at the Command Post or in an administrative area. Any visitor or observer approved for entry into any work area will be required to provide a copy of the physician's written opinion or acceptable substitute to the Crew Chief prior to site entry. The physician's written opinion of approval must be dated within 12 months of site entry.

The Crew Chief/SHO will be responsible for recording and reporting illnesses and injuries in accordance with OSHA requirements. Maintenance of the OSHA 300 Log will be the responsibility of the injured individual's supporting safety office. Recordable occupational accidents and illnesses are those defined in OSHA standard 29 CFR 1904. Should a recordable injury or illness involve a U.S. Army employee, it will be reported to the supporting safety office. Recording and reporting for CMA personnel will be handled by that office in accordance with AR 385-10. Should an accident or illness involve a contract employee, it will be reported in accordance with respective corporate plans, as well as to the supporting government safety office.



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## SECTION 6

### PPE

PPE will be worn by all personnel working within the EDS exclusion zone and Personnel Decontamination Station (PDS). PPE is designed to protect workers from known or suspected vapor, solid, and liquid contamination. The PPE levels for individual work tasks are specified and have been selected based upon the anticipated concentrations of contaminants that may be encountered, their chemical properties, toxicity, exposure rates, and contaminant matrix. **Table I-6-1** and **Appendix I-9** to this SHERP describe the PPE in greater detail.

Level C is recommended when air monitoring has confirmed that chemical vapor concentration within the EDS work area does not exceed allowable exposure limits of 1.0 short-term exposure limit (STEL). When chemical agent vapor concentrations exceed the allowable exposure limit of 1.0 STEL, then Level B must be donned.

Visitors authorized by the Crew Chief to enter the EDS operations area will be required to wear the prescribed task-specific PPE and are subject to relevant Army and OSHA requirements, such as training and medical surveillance. Prior to entry into the EDS operations area, all visitors will be required to undergo site-specific safety briefing and must be accompanied at all times by an EDS employee (buddy system) when in the exclusion zone.

#### 6.1 Different Levels of PPE

A health hazard assessment of the EDS operation was performed (Jacobs, 1999) using the guidelines from AR 40-10, *Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process*. Health hazards were assessed based on the hardware, process, and operational descriptions for the EDS Phase 1 that were

Table I-6-1. PPE Levels<sup>a</sup>

Task	PPE Requirement
Off-Normal Operations Involving Chemical Agent Alarm	Level B <ul style="list-style-type: none"> <li>• SCBA/SAR Respiratory Protection</li> <li>• Toxicological Agent Protective Ensemble Self-Contained or Trelleborg<sup>®</sup> or Tyvek<sup>®</sup> F</li> <li>• Chemical protective undergarments<sup>a</sup></li> <li>• Butyl rubber boots</li> </ul>
Site Setup	Level D <ul style="list-style-type: none"> <li>• Long-sleeved shirts, as required</li> <li>• Trousers</li> <li>• Leather gloves</li> <li>• Steel-toed boots/shoes</li> <li>• Safety glasses</li> </ul>
Emergency Operations/Response	Level B <ul style="list-style-type: none"> <li>• SCBA/SAR Respiratory Protection</li> <li>• Toxicological Agent Protective Ensemble Self-Contained or Trelleborg or Tyvek F</li> <li>• Chemical protective undergarments<sup>a</sup></li> <li>• Butyl rubber boots</li> </ul>
Perma-Slik <sup>®</sup> Application	Level C <ul style="list-style-type: none"> <li>• NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Long-sleeved shirts and trousers</li> <li>• Nitrile gloves or equivalent, as required</li> <li>• Leather gloves, as required</li> <li>• Steel-toed boots/shoes</li> <li>• Safety glasses</li> </ul>
Handling Munitions/Chemical-Filled Cylinders Upon Initial Receipt and Assessment	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Butyl rubber apron or equivalent</li> <li>• Chemical protective undergarments<sup>a</sup></li> <li>• Leather gloves, as required</li> </ul>

Table I-6-1. PPE Levels<sup>a</sup> (Continued)

Task	PPE Requirement
Transferring Reagent Between Reagent Drums and EDS Tanks	Level C <ul style="list-style-type: none"> <li>• NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved, nonstandard gloveset) or equivalent</li> <li>• Butyl rubber apron or equivalent</li> </ul>
Sampling Liquids/Vapors and Sampling Liquid Treatment Waste	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Butyl rubber apron or equivalent</li> <li>• Chemical protective undergarments<sup>a</sup></li> </ul>
Opening EDS Containment Vessel Door	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Leather gloves, as required</li> <li>• Toxicological Agent Protective Ensemble Self-Contained or Trelleborg or Tyvek F</li> <li>• Butyl rubber apron or equivalent, as required</li> <li>• Chemical protective undergarments<sup>a</sup></li> </ul>

Table I-6-1. PPE Levels<sup>a</sup> (Continued)

Task	PPE Requirement
Sampling Solid Waste and Removal of Munition/FSS Body	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Leather gloves, as required</li> <li>• Butyl rubber apron or equivalent</li> <li>• Chemical protective undergarments<sup>a</sup></li> </ul>
Handling Cleared Liquid Waste Drums	Level D <ul style="list-style-type: none"> <li>• Long-sleeved shirts and trousers</li> <li>• Leather gloves</li> <li>• Steel-toed boots/shoes</li> <li>• Safety glasses</li> <li>• Butyl rubber apron or equivalent</li> </ul>
Handling Uncleared Liquid Waste Drums	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Leather gloves, as required</li> <li>• Toxicological Agent Protective Ensemble Self-Contained or Trelleborg or Tyvek F</li> <li>• Butyl rubber apron or equivalent, as required</li> <li>• Chemical protective undergarments<sup>a</sup></li> </ul>
Routine and Occasional Maintenance	Level D <ul style="list-style-type: none"> <li>• Long-sleeved shirts and trousers</li> <li>• Nitrile gloves or equivalent, as required</li> <li>• Leather gloves, as required</li> <li>• Steel-toed boots/shoes</li> <li>• Safety glasses</li> </ul>

Table I-6-1. PPE Levels<sup>a</sup> (Continued)

Task	PPE Requirement
Site Operations Support Personnel Data Collection Project Observers Visitors Nonchemical Workers	Level D <ul style="list-style-type: none"> <li>• Slung or readily available mask (M40-series, escape mask, escape bottle, or NIOSH-approved respirator for industrial chemicals [for example, North 7600 with HEPA and acid gas organic vapor cartridge])</li> <li>• Long-sleeved shirts</li> <li>• Trousers</li> <li>• Gloves, as required</li> <li>• Steel-toed boots/shoes</li> <li>• Safety glasses, as required</li> </ul>
DAAMS Technicians (when collecting tubes and monitoring is above 0.7)	Level B <ul style="list-style-type: none"> <li>• SCBA/SAR Respiratory Protection</li> <li>• Toxicological Agent Protective Ensemble Self-Contained or Trelleborg or Tyvek F</li> <li>• Butyl rubber boots</li> </ul>
DAAMS Technicians (when collecting tubes and monitoring is 0.7 or below)	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Butyl rubber apron or equivalent</li> </ul>
DAAMS Technicians (when installing/collecting DAAMS tubes and no chemical agents are present in the EE)	Level D <ul style="list-style-type: none"> <li>• Slung mask (M40-series)</li> <li>• Long-sleeved shirts and trousers</li> <li>• Gloves, as required</li> <li>• Steel-toed boots/shoes</li> <li>• Safety glasses</li> </ul>

Table I-6-1. PPE Levels<sup>a</sup> (Continued)

Task	PPE Requirement
Decontamination Personnel	Level C <ul style="list-style-type: none"> <li>• M40-series mask or NIOSH-approved respirator for industrial chemicals (for example, North 7600 with HEPA and acid gas organic vapor cartridge)</li> <li>• Hood</li> <li>• M2A1 butyl rubber boots with safety toe or equivalent</li> <li>• Butyl rubber gloves (M3, M4, or approved nonstandard gloveset) or equivalent</li> <li>• Butyl rubber apron or equivalent</li> </ul>

Notes:

- <sup>a</sup> Protection levels may be downgraded or modified on approval from the EDS System Operations Manager. Chemical protective undergarments are not required to be worn where agent exposure is deemed low risk, provided the operations are continually monitored with real-time low-level devices with alarm set at or below the airborne exposure limit (AEL) or when not processing mustard.

DAAMS = Depot Area Air Monitoring System  
EDS = Explosive Destruction System  
EE = Environmental Enclosure  
FSS = Fragment Suppression System  
HEPA = high efficiency particulate air  
NIOSH = National Institute for Occupational Safety and Health  
PPE = personal protective equipment  
SCBA/SAR = self-contained breathing apparatus/supplied air respirator

available at that time. Changes that have been made for the EDS Phase 1 and Phase 2 did not impact the identified hazards and the analysis remains valid. Controls were identified to reduce exposure of the EDS operators to hazards at an acceptable level. The health hazards addressed in the assessment included toxic and/or combustible chemical substances (munition or DOT cylinder components/fills, process and support materials, process emissions/waste streams), noise, heat stress, and non-ionizing radiation. The tasks that were evaluated and the PPE recommendations were incorporated into **Table I-6-1**.

## **6.2 PPE Deviation/Modification**

Protection levels may be downgraded and/or modified only upon prior written approval from the EDS System Operations Manager. The EDS Crew Chief will initiate requests for deviation/modification and obtain the concurrence of the CMA RMD Manager.

The following site-specific, safety-related factors may require upgrading, downgrading, or modification of PPE levels:

- a. Worker experiences symptoms possibly related to chemical exposure or heat stress
- b. Change in work tasks with the EDS
- c. Change of season/weather
- d. Use of chemicals for maintenance other than those previously identified
- e. Change in work environment that affects the degree of contact with contaminants.



### 6.3 Limitations of PPE

PPE ensembles designated for use during work tasks have been selected to provide protection against contaminants at known or anticipated concentrations. However, no protective garment, glove, or boot is chemical-proof, nor affords protection against all chemical types. Permeation of a given chemical through PPE occurs when molecules pass through openings or interstices of the garment. It is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protective garment, and the resistance of a garment to a specific contaminant. Chemical permeations may continue even after the source of contamination has been removed from the garment.

In order to obtain optimal performance of PPE, the following procedures are to be followed by all site personnel using PPE:

- a. Military-issue chemical protective clothing, including M40 protective masks and explosive handlers' coveralls, will be drawn from Clothing Issue.
- b. Disposable (commercially procured) protective clothing will be inspected both prior to and during use for imperfect seams, non-uniform coatings, tears, and poorly functioning closures.
- c. Reusable garments, boots, and gloves will be inspected both prior to and during use for visible signs of chemical permeation, swelling, discoloration, stiffness, brittleness, cracks, any sign of puncture, and any sign of abrasion. *Note: Garment must have valid inspection date on tag prior to donning.*

Commercial gloves, boots, or coveralls exhibiting any of the characteristics previously listed will be discarded. Military equipment exhibiting any of these symptoms will not be used and will be returned to the clothing issue point.

Any non-disposable PPE that has been contaminated with blood must be separated from normally laundered PPE. This is to protect laundry workers from bloodborne pathogen exposure. PPE that is contaminated with blood will be placed in appropriate containers that are labeled as BIOHAZARD per OSHA 1910.1030(g)(1) and disposed of in accordance with all Federal, State, and local regulations.

#### **6.4 Donning PPE**

Work uniforms/PPE will be donned in the designated support zone before entering the CRZ. The Crew Chief will ensure that PPE is properly donned before workers perform tasks. Workers will don hearing protection before entering areas requiring it.

Before a worker wears any level of PPE, it will be checked to ensure that it is in proper condition for the purpose it is intended. Workers with any minor injuries and/or openings in the skin surface, such as cuts and scratches, will be given special attention to protect such areas, which may potentially enhance exposure effects. Workers with large cuts, rashes, or other such skin damage will not be allowed to don PPE. The Crew Chief or SHO, in consultation with occupational health personnel, will determine when an employee may not be able to wear PPE or perform other duties.

After donning the equipment, proper fit will be evaluated by the Crew Chief/SHO or another qualified person before the worker is allowed to enter the CRZ or exclusion zone.

## **6.5 Respiratory Protection Program**

All personnel issued respiratory protection are enrolled in the Respiratory Protection Program. The program includes a physical evaluation for fitness to wear a respirator; training in how to don, wear, and care for the respirator; and the signs and alarms used to notify personnel when to don their mask.

**6.5.1 Supplied Air Respirators (SARs) and Self-Contained Breathing Apparatuses (SCBAs).** Personnel who may be responding to situations involving unknown concentrations of hazardous chemicals will use SARs or SCBAs.

Breathing air must meet the specification for grade D breathing air as described in the Compressed Gas Association Specification G-7.1-1989 and in accordance with 29 CFR 1910.134(i). Vendors supplying breathing air will be required to certify the air meets the grade D breathing air specification. Quality verification may be based on production qualification tests or lot acceptance tests as agreed upon by supplier and the EDS Crew Chief/SHO.

**6.5.2 Escape Breathing Apparatus (EBA).** Commercial EBAs will be used. These EBAs will be National Institute for Occupational Safety and Health (NIOSH)-approved. Units will use a 10-minute (or greater rating) cylinder and airline system.

**6.5.3 SAR.** EDS operators will be supplied air from a cascade fed cluster system. The compressor is capable of providing grade D breathing air to the cascade system. The cascade trailer is located outside and adjacent to the EE. The air lines are routed through the wall of the EE where they are secured to the interior wall until needed. The air lines inside the EE are capped with a closed quick-connect that prevents back flow.

**6.5.4 SCBA.** Commercial positive pressure demand Interspiro™ SCBAs will be used. These SCBAs will be NIOSH-approved. Units will be used with 60-minute rated cylinders. If a cascade bottle system is used to supply air to the operators, an escape SCBA bottle will be worn.

## **6.6 APRs**

### **6.6.1 Masks.**

**6.6.1.1 M40.** Military issue M40A1 masks will be used for both emergency escape and normal operations. The M40A1 is a full-face APR with C2A1 canister used for military-unique chemicals. The M40A1 masks will be turned in to mask issue in accordance with U.S. Army policies if they have been used for an emergency escape or on a periodic basis as scheduled.

**6.6.1.2 NIOSH-Approved Respirator.** NIOSH-approved respirators (MSA or North) will be used for both emergency escape and normal operations during use of industrial chemicals. The NIOSH-approved respirator will be a full-face APR with high efficiency particulate air (HEPA) organic vapor cartridges used for industrial chemicals.

**6.6.2 Cartridge Change Frequency.** The APR canisters will be changed every 6 months or whenever there has been a confirmed exposure because of a spill or other type of process upset. The C2A1 canister will be discarded within 6 hours of exposure. The APR and C2A1 canisters will be managed onsite by the ECBC SHO.

**6.6.3 APR Limitations.** APRs are not to be used in situations where atmospheric contaminant concentrations are unknown, when oxygen levels are below 19.5 percent or above 23 percent, or concentrations of contaminants are immediately dangerous to life and health. ECBC personnel are not authorized to wear the M40A1 masks in sulfur mustard operations; therefore, personnel must wear SCBA/SAR respiratory protection.

## **6.7 Fit-Testing for APRs**

Masks will be fit-tested by personnel assigned to the issue point. The test will be quantitative for the masks. Personnel trained in fitting military masks perform all fit-testing. A fit-test record will be maintained at the mask issue point. Commercial respirators will be fit-tested at the issue point. The fit-test record will include information such as the name of the person wearing the respirator, the name of the person supervising the test, location, date and time, signatures of personnel involved, details of respirator type, and test(s) performed.

When donning the mask, operators will perform a positive- and negative-pressure fit-check when clearing and checking the mask. Workers are trained annually in donning, clearing, and checking masks.

## **6.8 General Safety for Respirator Use**

The following general safety guidelines for respirator use will be adhered to during EDS activities.

**6.8.1 Inspection and Cleaning.** In addition to the inspection and testing performed by the ECBC issue point, the APRs will be checked periodically by the Crew Chief/SHO and the person receiving the mask. Masks will be assigned to specific individuals at the mask issue point. Personnel required to wear SARs will be trained and certified to use them. Inspections of these respirators will be recorded. If liquid agent contaminates the face mask and/or air hose, it will be replaced.

Before transporting the EDS to DPG, the air lines will be evaluated for agent contamination. If contaminated, the lines will be decontaminated prior to transport. At the DPG site, the same air lines will be inspected prior to use. As the cascade system

is located outside the EE, previous operation would have had little chance of contamination.

**6.8.2 Respirator Restrictions.** The following respirator restrictions will be strictly adhered to during all field activities:

- a. *Facial Hair.* Personnel with facial hair, such as a beard or mustache that may interfere with the respirator seal, will not be permitted to wear the respirator and hence not be permitted to work.
- b. *Corrective Lenses.* Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the respirator sealing surfaces. Workers requiring corrective lenses will be provided with spectacle inserts designed for use with the type of respirator they are issued. Contact lenses will not be permitted with any type of respirator, unless prior written approval is received from the authorized party(s) (for example, CMA). This approval may be necessary in the event an individual needs to don a chemical agent APR for escape purposes only.
- c. *Dentures.* The absence of one or both dentures can seriously affect the fit of a respirator. Workers with dental appliances will be fit-tested with or without the appliance as they prefer. Once an acceptable fit is achieved, the worker will always wear the appliance as it was worn during fit-testing.
- d. *Head Gear.* Workers will not be permitted to wear a hat or cap that projects under the edge of the respirator or otherwise prevents a good seal of the respirator to the face.

- e. *Other Apparel.* Any apparel that interferes with a satisfactory fit of the respirator will be altered or removed as necessary to restore a satisfactory respirator fit.

## **SECTION 7**

### **AIR MONITORING**

The EDS will be deployed at the EDS at DPG site inside an EE and air monitoring for worker safety will be performed. ECBC will be the lead agency with responsibility for air monitoring during operations at DPG. Monitoring for worker safety will be performed for chemical agents using MINICAMS and DAAMS.

Detailed monitoring guidance is provided in the Site-Specific Monitoring Plan (**Annex E**).



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## SECTION 8

### SITE CONTROL

Site control is used to control movement of personnel and equipment to minimize worker exposure to hazardous conditions. The following paragraphs describe the various aspects of site control at the EDS at DPG site.

#### 8.1 Work Zones

The EDS site should have a clearly marked boundary for the exclusion area. Signs identifying the work site must be placed at the main access points. Use of PPE within this area is in accordance with this SHERP, EDS SOPs, and installation policies if applicable.

**8.1.1 Designation of Work Zones.** The work areas should be clearly demarcated into three zones: an exclusion zone (the exclusion zone for operations will be that area that falls within the footprint of the EE); a CRZ, which would include the PDS; and a support zone (includes all nonagent support activities).

The work zones may not be located within continuous zones, but are designated according to potential for contamination and activities normally conducted in that area. All workers must process into and out of the exclusion zone through the PDS.

- a. *Exclusion Zone.* The exclusion zone encompasses the area that might become contaminated, should a spill or leak occur. This includes the area inside the EDS EE.

- b. *CRZ.* The CRZ acts as a buffer in which decontamination of personnel will be performed, should a spill occur, and includes the PDS. Personnel leaving the EDS area must process through the PDS.
- c. *Support Zone.* The support zone includes any administrative, personnel staging, temporary waste storage, reagent supply areas, and all management support activities. PPE will be used in these areas in accordance with site policies.

**8.1.2 Site Control.** In order to minimize the potential spread of contaminated material from the exclusion zone to clean areas due to site activities, and to reduce the possibility of exposure to personnel in clean areas, control procedures will be implemented at the site. The Crew Chief or a designated representative will control access to the work site (including the support zone, CRZ, and the exclusion zone). Warning signs will be placed at the entrance to the CRZ stating "Authorized Personnel Only," and the PDS operator will control access to the CRZ and exclusion zone should an emergency situation occur. Site access will be documented on a daily log.

## **8.2 General Work Rules**

**8.2.1 Site Safety Training.** Safety briefings will be held at the EDS at DPG site before project startup and daily throughout the project. All site safety briefings will be documented in a daily log and personnel attending the safety briefing will sign a roster. No individual will be allowed to perform operations on the site without receiving the safety briefing. See **Appendix I-8** for safety briefing formats.

- a. *Initial Training.* Prior to being assigned to EDS operations, personnel will, at a minimum, demonstrate proficiency in EDS operations and/or EDS maintenance.

The training program consists of classroom instruction and hands-on exercises on the EDS Operating Systems, Concept of Operations, and Operator Maintenance. The students demonstrate familiarity with the EDS subsystems and operating procedures through written examinations and evaluated practical exercises. Upon successful completion of this training, the students are considered qualified to operate and maintain the EDS under supervision in accordance with the standards outlined in the PMNSCM Training Concept Plan and the EDS Workforce Qualification and Certification Program.

- b. *Daily Safety Briefings.* At the start of each workday, a safety briefing will be held with all EDS personnel. Selected topics associated with the work for the day will be outlined with applicable safety considerations. In addition, safety topics will be discussed (for example, use of PPE and level of PPE, location of safety equipment, rally point locations, actions to alarms, chemical agent release actions, proper decontamination, emergency procedures, applicable safety and health hazards to the operation, and proper sampling techniques). Any changes associated with SOPs and/or this SHERP will be addressed during these daily briefings.

**8.2.2 Buddy Systems.** Since treatment of chemical-filled items is a hazardous waste operation, all work will be performed in accordance with the “buddy system” requirements, as defined in 29 CFR 1910.120. The workers’ responsibilities under the buddy system include: providing their partner with assistance; observing their partner for signs of chemical or heat exposure; periodically checking the integrity of their partner’s PPE; notifying the Command Post or other site personnel if emergency assistance is needed; and detecting any unauthorized procedures.

Workers should not rely entirely on the buddy system to ensure that help will be provided in the event of an emergency. To augment the buddy system, EDS operators in the EE will have direct communications with the Command Post. Emergency communications will be discussed during the site safety meeting.

**8.2.3 Restrictions.** No eating, drinking, smoking, or other practices that can increase the probability of hand-to-mouth transfer and ingestion of contaminated material will be allowed within the EDS operations area. Drinking water will be located in the break areas of the EDS site. Smoking materials will be permitted only within administrative areas of the site. Smoking is allowed only in designated areas.

No jewelry or other articles that interfere with the use of protective clothing will be worn. No beards, sideburns, mustaches, or facial hair that interferes with face mask seals will be permitted.

The use of two-way radios in the monitoring room will not be permitted. Communication in this area will be conducted via an intercom system linked to the EDS Command Post.

In case of conflict, the Crew Chief (with input from his or her SHO) will be the final judge in determining the appropriateness of any object, feature, or activity that could cause interference or lead to a potentially unsafe condition.

### **8.3 Communication**

An intercom between the Command Post trailer and the monitoring room will be employed. The Command Post will communicate with the EDS operators via the use of two-way radios (throat microphone communication units). If landlines are not available, cellular phones will be employed to enable offsite communication. The Command Post will be manned at all times during operations by crew members.

## **8.4 Worker Safety Procedures**

Worker safety procedures include the procedures described in this SHERP, procedures described in task-specific SOPs, and various steps that have been taken in the design of the EDS at DPG site to confine potential hazards to the smallest possible area. The only place where CWM will be handled is in the EE, which is designed for chemical agent operations. The EE has a carbon-filtered exhaust system to maintain a negative pressure within the structure relative to the outside air and to capture any agent vapors that may result from a release of agent while an item is being prepared for placement in the vessel. Chemical agent air monitoring will be conducted using the low-level NRT MINICAMS that are positioned in key locations in the EE. All equipment and surfaces are designed and selected to be easily cleanable. Power tools are pneumatic rather than electrical.

## **8.5 Medical Assistance**

Should there be a medical emergency, the first person to recognize that an emergency exists will notify the SHO/EDS Crew Chief via hand signals, voice, or radio that an injury has occurred. The Crew Chief will initiate the emergency response process by calling DPG Range Control and inform the answering party of the type and nature of the emergency, the current location and what, if any, first aid was administered. A trained and qualified EDS team member may administer first aid to the worker, if needed. Emergency medical assistance and ambulance will be available during chemical operations.

If medical treatment appears to be necessary, the following medical facilities will be used for emergency care. The DPG ambulance crew will know which medical facility to use and are familiar with the routes.

Trauma and non-chemical agent exposed patients may be taken to:

U.S. Army Health Clinic

Phone: 435-831-2211

Chemical agent exposed patients may be taken to:

Ditto Aid Station

Phone: 435-831-5292

## **SECTION 9**

### **DECONTAMINATION**

Decontamination is the process of removing or treating contaminants from personnel or equipment. When performed correctly, decontamination protects personnel from contaminants that may have come in contact with PPE, tools, and other equipment and also serves as the principal means of preventing the transport of potentially harmful materials into uncontrolled areas.

To prevent transfer of contaminated material to “clean” areas, equipment removed from the EDS exclusion zone will be monitored, decontaminated if required, and checked for completeness before being removed from engineering controls.

Personnel decontamination will be performed in the PDS according to the following procedures.

#### **9.1 Personnel Decontamination**

Routine exposure of personnel to hazardous material is not expected as part of this operation, but as a precaution, all workers will shower at the end of the workday.

When an operator working in impermeable PPE has potentially been exposed to liquid agent, chemical reagents, or other contaminated materials and/or when directed by the Crew Chief, he or she will process through the PDS, which is located in the CRZ.

Should a spill occur, personnel will be decontaminated and monitored with a MINICAMS at the EDS PDS located within the CRZ (see **Figure I-9-1**). Adequately decontaminated personnel processed through this station then will proceed immediately to the shower



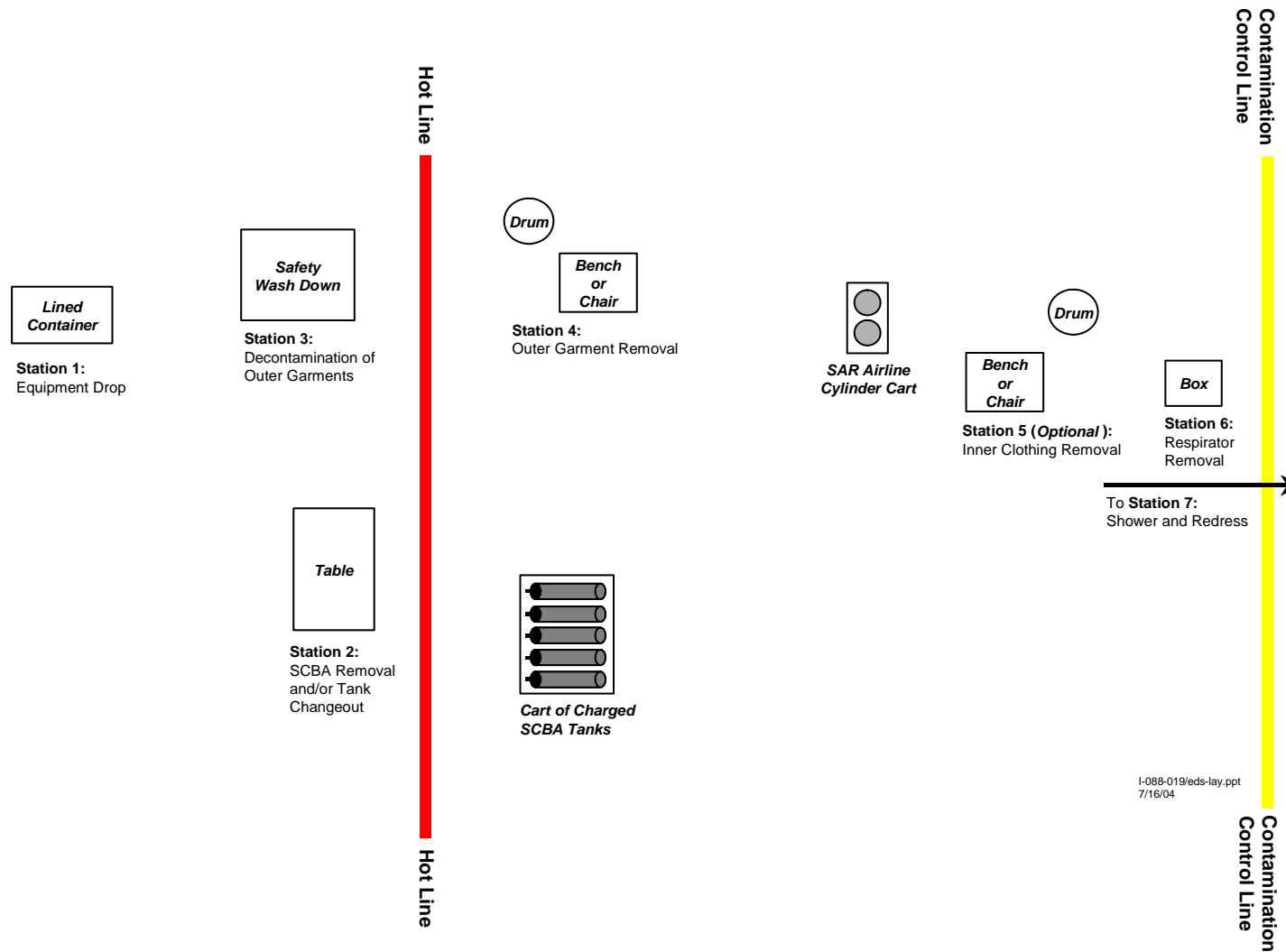


Figure I-9-1. Typical PDS Layout

for a full-body shower before donning clean coveralls or personal clothing. Any equipment contaminated because of a spill will be decontaminated before leaving the exclusion zone. Should anyone, including transients and observers, become contaminated; the individual will be decontaminated and monitored at the PDS.

Site access procedures, including the exclusion zone entry log will aid in determining personnel accountability with regard to decontamination procedures.

## 9.2 PDS (Typical)

The PDS will be located in a position that will minimize exposure of uncontaminated employees and equipment to contaminated employees and equipment. The PDS station will provide rapid and efficient egress from the exclusion zone while preventing the spread of contaminants. All EDS personnel are trained in and thoroughly familiar with decontamination and egress procedures. The PDS will be located directly outside the EE (at personnel entry/exit door) and a gross decontamination area will be established inside the exit personnel doorway. A typical PDS layout is shown in **Figure I-9-1**.

Note: All personnel believed to have been exposed to hazardous materials or substances will be required to process through the PDS using the following procedure:

- STATION 1.       *Equipment Drop.* Equipment used during the conduct of work in the EE will be placed on impermeable plastic sheeting or in containers clearly identified as the “equipment drop” (Station1).
- a.       *Equipment.* Plastic sheeting (approximately 8 by 8 feet) or lined containers (drums, boxes, etc.) for temporary holding of contaminated equipment.

- b. *Action.* Loose, hand-held tools and equipment will be placed on plastic sheeting or in a designated container.

STATION 2.

*SCBA Tank Removal and Tank Change.* Non-routine operations may require the use of SCBAs or airline respirators. Personnel wearing SCBA will be assisted with removal of tank and backpack assembly and connecting to airline. Attendants will assist personnel requiring only a tank change. Breathing protection will be maintained using the auxiliary air bottle. In the event of an alarm, operators will continue to wear SCBA through decontamination (Station 3) and then doff the SCBA for an M40 mask prior to leaving the PDS. (Note: Personnel assigned as attendants will be dressed out in Level C in accordance with section 6 of this SHERP and site policies.)

- a. *Equipment.* Airline SAR (cascade system) with low-pressure alarm and air hoses (as required), decontamination solution (generally soapy water), sponges or rags, plastic-covered table, large plastic bags, small plastic bags, wheeled cart, fully-charged SCBA tanks, and tape or zip-ties and in accordance with ECBC SOP.
- b. *Action.* Personnel wearing SCBA will move to the "hot line." Attendant will use a sponge or a rag that is damp with decontamination solution to wipe the hose connection to remove any contamination. The attendant then will connect the SAR airline to the hose on the SCBA, assist with the removal of the SCBA regulator assembly, place the regulator assembly in a small plastic bag, and seal the bag with tape or zip-tie. The attendant will assist with the removal of the

SCBA tank and backpack assembly and place both in a large plastic bag and seal the bag with tape or zip-tie.

STATION 3. *Decontamination of Outer Garments.* If an alarm sounds or a release is visually detected, individuals suspected of being contaminated will process through Station 3. Individuals wearing permeable outer garments (that is, Saratoga™ suits or cotton coveralls) will process through the shower as directed by the Crew Chief. Individuals wearing impermeable outer garments and connected to SAR will have garments decontaminated in the wash down area located at this station. The individual will stand in the shower; an attendant will apply soapy water with brushes, followed by a water rinse. Downward brush strokes (from head of individual downward) will be used to ensure that contamination will not be spread inadvertently. Brushes will be stored in buckets when not in use. All personnel will be visually inspected for gross contamination before proceeding to Station 4, located within the CRZ, and, subsequently, into the support zone. If contamination is noticed or suspected, the proper sequence of decontamination procedures will be reinitiated.

- a. *Equipment.* Sprayers, soap, emergency medical technician (EMT) shears, sump pump, plastic sheeting, absorbent pads, long-handled scrub brush (one at minimum), bucket (one at minimum), and a drum or similar container with tight or self-closing lid for collection of waste water.
- b. *Action.* Individual will stand in the wash down area as the attendant applies soapy water using a long-handled brush.

The attendant then will brush outer garments from the top down using downward strokes. If impermeable clothing is worn, the clothing will be washed and removed as directed by the Crew Chief. Next, the shower will be turned on and the clothing will be rinsed. The impermeable outer garment(s) will be doused well with warm, soapy water and rinsed. When directed, individual will step carefully out of the shower and onto an absorbent pad. Once all possibly contaminated personnel have been successfully decontaminated, attendants will pump water collected in the shower sump into a drum or similar container for sampling and subsequent disposal. Prior to exiting to the next station, decontamination will be verified via monitoring for agent. If agent is detected, the affected area must be decontaminated.

STATION 4. *Outer Garment Removal.* Attendant will assist individual with the removal of outer garments (suits, boots, gloves, etc.). Garments will be removed from the individual's head downward in such a way as to avoid exposing the individual to the outside of the garments. Once the garments are below the individual's waist, the individual will sit down and remove one leg at a time from the chemical protective suit and boot. Once removed, the garment should be completely inside out with all contamination on the inside. The attendant will place a moisture-resistant bootie on each foot of the individual. Disposable outer garments then will be placed in an appropriate container for sampling and disposal. Reusable garments, if worn, will be placed in a lined container for monitoring and proper cleaning.

- a. *Equipment.* Drum or similar container with tight or self-closing lids (the same container may be used to collect PPE from all stations, if appropriate), plastic-covered bench or chair, EMT shears, boot jack (if available), lined container for reusable garments, moisture-resistant booties, rubber mat, and absorbent pads.
- b. *Action.* PDS operator will assist an individual with the removal of outer garments (suits, boots, gloves, etc.) and will place garments in proper container. The attendant will place moisture-resistant booties on an individual's feet and visually inspect individual for gross contamination before the individual proceeds to the next station.

STATION 5. *Inner Clothing Removal.* The Crew Chief will decide if inner clothing removal is necessary. If necessary, attendant will assist individual in the removal of inner coveralls, gloves, etc. If all or most of an individual's inner clothing is removed, a robe and slippers will be issued. The individual then will proceed to Station 6 and to the building shower facilities (Station 7). Otherwise, only inner gloves will be removed at this station. The PDS operator will ensure that all clothing is appropriately containerized for sampling and disposal as required.

- a. *Equipment.* Drum or similar container with tightly or self-closing lids, plastic-covered bench or chairs, boot jack (if available), robes, and slippers.

- b. *Action.* If directed by the Crew Chief, the PDS operator will assist an individual with the removal of inner coveralls, gloves, etc., and will place inner garments in the proper container.

**WARNING: ENSURE THAT RESPIRATORY PROTECTIVE DEVICE (RPD) FACEPIECE REMAINS FULLY SEALED AND IN PLACE UNTIL INSTRUCTED TO REMOVE IT. FAILURE TO COMPLY MAY RESULT IN PERSONAL INJURY.**

STATION 6. *Respirator Removal.* The worker will remove the RPD and drop/place mask into a storage container for subsequent transfer to equipment decontamination area before proceeding. Masks then will be placed in plastic bags, marked to indicate the wearer's name, and placed in a storage box to await monitoring and proper cleaning. Individual then will proceed to the redress facilities (Station 7).

- a. *Equipment.* Box with liner and plastic bags.
- b. *Action.* Remove RPD and place in plastic bag. Attendant will disconnect airline from mask, as appropriate, and mark mask to indicate the wearer's name. The bagged RPD then will be placed in a storage box to await monitoring and proper cleaning. Individual will proceed to building shower facilities (Station 7).

- STATION 7.        *Shower and Redress.* The individual will take a full shower in the nearest shower facility or field shower, redress, and report back to the Crew Chief for instructions.
- a.        *Equipment.* Portable or fixed shower facilities, soap, shampoo, wash cloths, and towels.
  - b.        *Action.* Individual will take full-body shower (thoroughly wash hands, hair, neck, and face); then, will exit the shower, dry off, redress, and report back to the Crew Chief for further instructions.

Portable eyewashes (15 minute rated capacity) are available for immediate use as required. Splash protection can be washed and rinsed at the PDS, as required, with the approval of the Crew Chief/SHO. Should a worker's skin be exposed to liquid contamination, the worker will be completely processed through the PDS.

Workers wearing splash protection that have not come in contact with liquid contamination will remove and store or dispose of protective clothing when the assigned task is completed. If SCBAs are used during operations and air monitoring indicates that the concentration of hazardous chemicals was below the permissible exposure limit (PEL), the respirator may be removed without decontamination. The face mask, however, will be cleaned before being worn by a different worker.

### **9.3    Emergency Personnel Decontamination Station (EPDS) Procedures**

Emergency personnel decontamination(s) will be established and arranged in accordance with paragraph 9.2 of this SHERP. The EDS Crew Chief, in conjunction with the Safety/Surety/Security Manager for ECBC, will establish the EPDS and appropriate use protocol.



#### **9.4 PDS Non-routine or Emergency Egress**

In the event of a potentially contaminated worker, a MINICAMS will be available to perform NRT monitoring in the PDS. NRT monitoring at this location will be conducted at the STEL for the agent/chemical being processed and in accordance with ECBC procedures.

#### **9.5 Equipment Decontamination**

Equipment used outside the EDS exclusion zone should not encounter contamination under routine operations. Should chemical agent above the STEL be detected outside the exclusion zone and equipment be potentially contaminated, that equipment will be monitored and decontaminated.

Equipment used inside the EE that may have been contaminated with chemical agent will be decontaminated in the PDS after personnel have finished being decontaminated. Any equipment requiring decontamination will be wiped down with a decontamination reagent, such as 5 percent bleach in water, using a brush, sponge, or cloth. Then, the item will be rinsed with clean water and allowed to dry. After drying, the item will be bagged or placed in a shroud, allowed to equilibrate, and monitored for contamination. If contamination above the 1.0 STEL is detected, the item will be decontaminated again. After decontamination, items will be bagged and tagged to indicate the level of decontamination.

#### **9.6 Decontamination Waste Disposal**

Liquid waste and disposable PPE produced at the PDS will be containerized in containers that meet DOT standards and will be turned over to DPG for disposition. This waste will be sampled to determine if it has hazardous characteristics and will be handled by the waste contractor, as appropriate. Reusable PPE will be handled in

accordance with Army policies concerning monitoring and laundry. Every attempt will be made to reduce contamination on equipment to levels as low as reasonably achievable. Whenever possible, detergents and water will be used as decontaminants. Any reusable PPE contaminated by blood will be stored and handled separately in accordance with U.S. Army policy.

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## SECTION 10

### EMERGENCY RESPONSE AND CONTINGENCY ACTIONS

This section describes the emergency response and contingency actions that will be followed in the event of a fire, explosion, or any unexpected, unplanned release of hazardous materials, hazardous waste, or hazardous waste constituents during operations at the EDS at DPG site. These actions pertain to all operations at the EDS at DPG and apply to EDS at DPG site personnel, visitors, contractors, and external support personnel.

The EDS has been engineered in compliance with the *System Safety Management Plan for the Non-Stockpile Chemical Material Product* (PMCD, 2001) in order to reduce risks.

The EDS System Operations Manager or SHO will be responsible for ensuring that the appropriate procedures are followed. The DPG Range Control will be notified if any emergency or release (greater than 1 gallon of liquid or reportable quantities) condition occurs. **Tables I-10-1** and **I-10-2** list the organizations to be contacted when emergencies or release conditions occur. A copy of this SHERP will be maintained at the EDS at DPG Command Post.

#### 10.1 Specific Contingency Plans

Contingency plans for the site include measures to prevent emergencies or, if any emergency occurs, to limit the negative impact. The major aspects of these plans are:

- a. *Preventive Measures.* Measures that should prevent or limit an emergency incident.

Table I-10-1. Emergency Notifications

Situation	Telephone Number	Agency
Fire	911	DPG Security Dispatch
Medical Emergency (Ambulance)	<ul style="list-style-type: none"> <li>• Direct contact or local radio net</li> <li>• 911 (when ambulance is not onsite)</li> </ul>	Onsite ambulance crew
Chemical Agent Release Outside of Engineering Control	911	DPG Fire Department
Spill of Industrial Compounds Requiring Outside Assistance	911	DPG Fire Department
All Emergencies	Per DPG Radio Network	DPG Range Control
	110	DPG EOC

Notes:

DPG = Dugway Proving Ground  
EOC = Emergency Operations Center

Table I-10-2. PMNSCM Emergency Notifications

Situation	Agency	Notes
Accident Reporting	CMA RMD CMA EDS System Operations Manager CMA PMNSCM Representative PM ECW Site Representative	Notify as soon as possible after accident/illness occurs. Do not delay emergency assistance to make these notifications. This notification made by EDS System Operations Manager.
Chemical Event	CMA RMD CMA EDS System Operations Manager CMA PMNSCM Representative PM ECW Site Representative	Do not delay emergency response to make these notifications. Notification of reportable spills must be made even when cleanup is handled by operating personnel. This notification made by EDS System Operations Manager.
Non-emergency Change in Level of PPE Required	CMA EDS System Operations Manager CMA RMD Safety/Surety/Security Office (ECBC)	Approval of change must be received before operations resume. This notification made by EDS System Operations Manager.
Daily Start and End of Operations	DPG Range Control	Daily reporting

Notes:

CMA = U.S. Army Chemical Materials Agency  
 DPG = Dugway Proving Ground  
 ECBC = Edgewood Chemical Biological Center  
 EDS = Explosive Destruction System  
 PM ECW = Program Manager for the Elimination of Chemical Weapons  
 PMNSCM = Project Manager for Non-Stockpile Chemical Materiel  
 PPE = personal protective equipment  
 RMD = Risk Management Directorate

- b. *Response Actions.* Specific actions to be taken as a specific response to an emergency situation.
- c. *Notification.* Response organizations or personnel to be notified in case of an emergency.

**10.1.1 Preventive Measures.** The following measures will be implemented to prevent or limit an emergency incident:

- a. Strictly adhere to the SOPs, including the use of prescribed PPE during all onsite activities.
- b. Set up the PDS prior to work with hazardous materials.
- c. Determine the evacuation route and rally point, and communicate it to workers during the daily safety briefing.
- d. Keep standard absorbent materials, shovels, and overpacks onsite to contain a spill or leak. A review of the EDS consumable list and verification checklist will be used to ensure appropriate inventories of these materials.
- e. Discontinue operations when inclement/hazardous weather conditions pose a threat to the safe working environment. Some of the items to be considered prior to determining if work should continue are:

- (1) Potential for heat stress and heat-related injuries

- (2) Severe weather-related working conditions (for example, fog, heavy rain)
- (3) Potential for electrical storms.

## **10.2 Emergency Planning**

Response actions by EDS at DPG personnel for spills or releases will depend on whether the release occurs within or outside of engineering control, can be safely managed using EDS site personnel and resources on hand, and if the release involves chemical agent. Any spills or releases will be immediately assessed by the EDS System Operations Manager or designee to determine the following information: material(s) involved; exact source of release; quantity of release; release classification: (1) release to the environment (not wholly contained in the EE) or (2) release contained; extent of any materials released to the environment; and extent of injuries.

Releases or spills occurring within engineering controls or for an incident at the EDS site that can be managed using available EDS at DPG site supplies and resources will be managed by EDS site personnel. The DPG Range Control will be notified if any emergency (greater than 1 gallon liquid or reportable quantities) condition occurs. Spills beyond the management capability of the EDS System Operations Manager will be managed by DPG personnel under their emergency response procedures.

Spills or releases outside of EDS engineering controls or those that cannot be managed using EDS site personnel and resources will be handled in accordance with the DPG Chemical Accident/Incident Response and Assistance (CAIRA) Plan.

DPG emergency responders, including fire and medical personnel, will be on duty during EDS operations. The DPG Fire Department and the U.S. Army Health Clinic will



provide the emergency and medical response to the EDS at DPG site at the request of the EDS System Operations Manager through the Range Control office.

If the incident is beyond the capabilities of EDS at DPG response personnel, the EDS System Operations Manager or designee will contact the DPG Range Control.

Emergency responders may be reached by calling the DPG Fire Department (911) as indicated in **Table I-10-1**.

### **10.3 Amendment of Emergency Response and Contingency Action**

These emergency response and contingency actions will be reviewed and amended if necessary when:

- Applicable regulations are revised
- Actions fail in an emergency
- Facility changes in its design, construction, operation, maintenance, or other circumstances in a way that materially increases potential for fires, explosions, or release of hazardous materials or hazardous waste/constituents or changes response necessary in an emergency
- List of emergency equipment changes.

### **10.4 Emergency Equipment at EDS at DPG Site**

Spill kits will be located inside the EE and the PDS. The spill kit will contain spill pillows and assorted items to facilitate the containment and reduction of liquid spills.

Additionally, shovels, brooms, portable decontamination sprayers, and other such equipment will be located at the EDS at DPG site to further aid in the containment of

any liquid spills. Other emergency equipment will be provided on an as-needed basis by DPG emergency response services.

## **10.5 Response Actions**

This section describes response actions that will be used for incidents or events requiring some action by EDS at DPG site personnel, visitors, contractors, and external support personnel for the following categories: events involving CWM; events involving non-CWM, medical assistance; fire/explosion; severe weather; and external arsenal events.

**10.5.1 General Spill or Release Response.** The following actions will be followed for spills or releases that occur within engineering controls and/or that can be reasonably handled using EDS site personnel and resources on hand.

1. Wear appropriate protective clothing per the direction of Site Safety and Health Officer.
2. Contain the spill in the smallest area possible using absorbent socks, berms, or other means.
3. Repair or plug the leak, if possible.
4. Decontaminate the release area using installation policies and DA Pam 385-61 as needed.
5. For container spills, place container in overpack or remove container contents, if necessary, using a portable pump, and transfer material to a new container. If the material was released to secondary containment (for contents released from a container), released material either will be

pumped out of the containment area using a portable pump or absorbed using compatible absorbent materials such as pillows, socks, or granules.

6. Decontaminate equipment and clothing as directed by the EDS System Operations Manager as applicable.
7. Manage spent chemical agent decontamination solutions and other waste decontamination solutions as hazardous waste.
8. Place absorbed or pumped material into DOT-approved containers, label appropriately, and store in a less than 90-day storage area pending shipment to a permitted treatment, storage, and disposal facility.

**10.5.2 Events Involving CWM.** If exposure to chemical agent is suspected or symptoms of agent exposure develop, operators will hold their breath and immediately don escape masks, sound the air horn (one long blast) or give verbal warning (if workspace alarm has not sounded), and report to the PDS area or rally point.

The Crew Chief/SHO will notify the DPG Range Control of the suspect or known release and of any casualty requiring immediate medical attention. Casualties will be processed through the PDS if injuries permit. Decontamination will not be delayed until the arrival of medical personnel unless physical injuries prevent safe movement of the casualty. Operators not showing symptoms of agent exposure will be processed through the PDS and will stand by for further instruction. The EE provides engineering control so that personnel outside the EE will not be exposed to hazardous concentrations of chemical agent vapors.

Under no circumstances will incoming personnel or visitors be allowed to proceed into the CRZ once the emergency signal has been given unless authorized. Further

emergency response to chemical agent release and injuries will be directed by the DPG Range Control.

**10.5.3 Events Involving Non-CWM Hazardous Materials.** When an incident occurs involving non-chemical agent hazardous materials (for example, chemical reagents, industrial solvents, decontamination agents, fuels, etc.) in a quantity that cannot be managed by EDS site personnel and resources on hand, the EDS System Operations Manager will contact DPG Range Control. Otherwise, the EDS operators will respond using materials contained in the spill kits and follow the general spill or release response steps.

Typical responses to chemical exposure emergencies shall include:

- *Inhalation.* Move to fresh air and call for emergency assistance as indicated in the subsequent paragraphs.
- *Skin Contact.* Use copious amounts of soap and water. Wash and rinse affected area thoroughly, then provide appropriate medical attention. An eyewash will be provided at the EDS PDS. Eyes should be rinsed for 15 minutes upon industrial compound exposure. Drenching, if required, will be performed at the PDS.
- *Ingestion.* Call for emergency assistance and process through the PDS immediately.
- *Puncture Wound or Laceration.* Call for emergency assistance as indicated in the subsequent paragraphs. If chemical materials are involved, process through PDS immediately. If no chemical materials are involved, processing through PDS is not required.

**10.5.4 Industrial Accidents and Medical Emergencies Assistance.** If a worker is injured or becomes ill on the job, trained co-workers will implement first aid/CPR if necessary. Emergency medical guidance and assistance will be provided by the DPG emergency services. The DPG fire department will be contacted at 911 (post landline) and the DPG Range Control.

For CWM exposures, personnel shall follow the DPG CAIRA Plan. Additionally, procedures relative to medical monitoring and post-exposure results are established by the DPG Medical Director and will be adhered to in the event of individual exposure.

**10.5.5 Potential or Actual Fire or Explosion.** Evacuation diagrams will be posted conspicuously throughout the EDS at DPG site. A common rally point shall also be identified. The EDS has been designed to minimize the possibility of a fire associated with the system. The EDS uses electrically powered equipment, combustible liquids, and compressed gas in various operations.

When a fire is spotted by a team member, he or she will sound an alarm (that is, an air horn). The operator must inform the EDS System Operations Manager of the size and location of the fire. If the fire is small, the operators may attempt to extinguish it using a portable fire extinguisher. If this attempt is successful, the crew member will inform the EDS System Operations Manager of the fire status. If the fire is large, involves materials that present an increased hazard to the crew member, or the first attempt to control the fire was unsuccessful, the crew members will evacuate the area and inform the EDS System Operations Manager.

The EDS System Operations Manager will contact the Emergency Operations Center (EOC) and request assistance. This contact should include a description of the type and size of the fire, the location of the fire, and the method for contacting the EDS System Operations Manager. The EDS System Operations Manager will account for all personnel, including visitors, on the site.

Regardless of the size of the fire, the EOC will be called. They will be informed of the nature of the fire and whether or not items containing chemical agents are involved.

**10.5.6 PPE Failure.** If any site worker experiences a PPE failure that affects the protective ability of the equipment, that person will immediately inform the Crew Chief and report to the PDS for assistance. Re-entry to the EDS operations area will not be permitted until the equipment has been repaired or replaced and the EDS Crew Chief has granted permission.

**10.5.7 Physical Injury.** Emergency first aid shall be applied onsite as necessary. A first-aid kit is available at the PDS. For minor non-emergency physical injuries requiring medical treatment beyond onsite first aid, the casualty will be transported to the nearest healthcare facility.

**10.5.8 Severe Weather.** The DPG Range Control will inform the EDS Command Post of weather advisories such as severe weather watches or warnings. The EDS System Operations Manager and SHO will consider this information and make modifications to the work schedule as appropriate to ensure worker safety. During severe weather, when notified, all personnel exposed to the elements will report to the designated safe location. When lightning is detected, all EDS operation activities will cease.

The EDS System Operations Manager will develop a list of key personnel and ensure employee awareness. In the event that DPG is closed (due to severe weather), the EDS System Operations Manager will notify key personnel to report to the site to ensure continued safety of any CWM, to ensure that critical equipment (such as monitoring equipment and ventilation equipment) is maintained, and so that once the order to reopen the base is given, activities at the EDS at DPG site can proceed with a minimum of interruption.

**10.5.9 External DPG Emergencies.** The potential exists that an accident or incident somewhere else on DPG will require evacuation of the EDS at DPG site. The DPG Range Control will inform the EDS Command Post of such emergencies should they occur.

**10.5.10 Evacuation Plan.** Personnel assigned to the EDS site will be instructed in evacuation signals, procedures, and routes from the EDS site.

An evacuation route from the EDS site will be determined prior to operations.

Evacuation procedures are as follows:

- a. The EDS System Operations Manager or designee will make the decision to evacuate.
- b. Upon direction to evacuate, the EDS System Operations Manager or designee will notify all personnel in the area of an evacuation by an audible alarm and/or vocal command.
- c. If an incident occurs inside the EE, non-essential personnel (as defined by the EDS System Operations Manager) will don protective masks and will proceed outside to an upwind assembly point. All essential personnel will don protective masks (unless already in higher level PPE) and will rally at the PDS to prepare for decontaminating the affected contaminated area. If the incident has occurred outside the environmental enclosure, the same procedure will be followed and all non-essential personnel will be evacuated from the assembly point to a safe distance, upwind of the incident. Windsocks located at the site will indicate wind direction.

- d. The EDS System Operations Manager will identify the evacuation route from the EDS site based on the type of incident and prevailing wind.
- e. The EDS System Operations Manager or designee will contact the DPG Operations Center by phone or radio and will indicate the number of personnel requiring transportation from the assembly point as necessary.
- f. If required, transportation will be provided for all personnel at the designated assembly point. Personnel who are injured or may have been exposed to hazardous chemicals or chemical agents will be decontaminated in the EDS PDS, then will be taken immediately to the Ditto Aid Station.

**10.5.11 Notification.** The primary responsibility for notification will lie with the Crew Chief with assistance from all other field personnel. **Tables I-10-1** and **I-10-2** provide information for the responsible person or agency.

**10.5.12 Critique of Response and Follow-up.** Formal accident investigation will be conducted by the CMA and/or supporting safety office in accordance with procedures identified in AR 385-10. Should changes to EDS operations be required, those changes will be approved by CMA RMD, ECBC Risk Management Office (RMO), and the supporting safety office prior to resumption of EDS operations.

**10.5.13 Worker Population Limit (WPL) Excursion.** **Annex J** of the EDS at DPG Destruction Plan describes procedures to follow in the event of a chemical agent WPL excursion.



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## **SECTION 11**

### **DOCUMENTATION**

The EDS SHO will be responsible for maintaining safety-related documentation. The EDS SHO is also responsible for recording and reporting illnesses and injuries in accordance with Army and OSHA requirements and this SHERP.

#### **11.1 Accident Reporting and Recording**

Accidents will be reported and recorded in accordance with the provisions in DA Pam 385-40, *Army Accident Investigation and Reporting*, and Department of Defense Instruction 6055.7, *Mishap Investigation, Reporting and Recordkeeping*. Occupational illnesses will be reported in accordance with AR 40-5, *Preventive Medicine*.

Injuries and illnesses of government employees will be reported through the appropriate chain of command. Recording and further reporting of these injuries and illnesses will be the responsibility of the DPG Safety Office. If an injury or illness occurs to a contract employee onsite, the SHO will notify the DPG Safety Office and create an OSHA 300 Log. Recordable accidents and illnesses are defined in 29 CFR 1904.

#### **11.2 Safety Documentation**

The following documentation will be maintained by the SHO.

**11.2.1 Log In/Out Book.** Each person (including visitors) entering the EDS site will be required to sign in and out in the daily log located in the Command Post, indicating their name and the date and time of entry or exit. This log will be maintained by the senior PDS operator and turned in at the conclusion of each day's operation.

**11.2.2 Accident/Mishap Report.** An accident report will be made via telephone by the Crew Chief (or SHO in his or her absence) when any one or more of the following occur as a result of an accident or incident: fatality, injury that requires medical attention, occupational illness, damage to any safety equipment, fire, chemical exposure, or hazardous material spill. This phone call will be documented in the safety logbook. The telephone report will be made to the supporting safety office. These offices will make further notifications in accordance with existing policies.

The EDS Crew Chief will document circumstances surrounding the accident. Additional documentation may be required by the supporting safety office or CMA RMD.

DA Form 285, *U.S. Army Accident Investigation Report*, will be prepared by the SHO as required by Army regulations. This report will be completed as soon as enough information is known to complete all parts of the form.

**11.2.3 Site Safety Documents.** The Crew Chief/SHO will maintain a daily record of safety briefings, attendance, and topics, inspection of safety equipment, and records of accidents and incidents.

**11.2.4 Resource Documents.** The following source documents will be maintained at the EDS at DPG site:

- MSDSs for the chemical agents and industrial chemicals that may be contained in the items to be processed at the EDS at DPG site. Suppliers will provide an MSDS for any hazardous material that may be purchased for operation of EDS at DPG equipment (for example, sodium hypochlorite for the PDS). In accordance with 29 CFR 1910.1200 (OSHA Hazard Communication Standard), the SHO will discuss the MSDSs at the safety meetings. Copies of MSDSs will be maintained and will be available at the EDS Command Post.

- SHERP – This plan will be kept at an easily accessible location onsite.
- O&M manuals for the EDS – A copy of the O&M Manual will be maintained onsite.
- SOPs for the EDS – A copy of the EDS SOPs will be maintained onsite.
- Site Monitoring Plan – A copy of the Site Monitoring Plan will be maintained onsite.
- Destruction/Test Plan – A copy will be maintained onsite.
- Manuals for other site equipment, as appropriate – Examples are manuals for respiratory protection devices, air monitoring SOPs, and leak detection equipment.

### **11.3 Deviation from or Modification of the SHERP**

Any change (other than editorial), such as upgrading/downgrading PPE, requires prior approval from CMA RMD and ECBC RMO. All deviation(s) or modification(s) to this SHERP will require prior written approval from the EDS System Operations Manager. The EDS Crew Chief will initiate requests for deviation/modification and obtain concurrence from all parties, as outlined in **Table I-2-1**, Safety Responsibilities.

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## **APPENDIX I-1**

### **ACRONYMS/ABBREVIATIONS**

## **APPENDIX I-1**

### **ACRONYMS/ABBREVIATIONS**

ACGIH	American Conference of Governmental Industrial Hygienists
AMC	Army Materiel Command
APR	air-purifying respirator
AR	Army Regulation
BEI	Biological Exposure Index
bpm	beats per minute
CAIRA	Chemical Accident/Incident Response and Assistance
CASARM	Chemical Agent Standard Analytical Reference Material
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CMA	U.S. Army Chemical Materials Agency
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
CSC	conical-shaped charge
CWC	Chemical Weapons Convention
CWM	chemical warfare materiel
DA	Department of the Army
DA Pam	Department of the Army Pamphlet
DAAMS	Depot Area Air Monitoring System
dB(A)	decibels using an "A" weighted scale
DoD	Department of Defense

DOT	Department of Transportation
DPG	Dugway Proving Ground
EBA	escape breathing apparatus
ECBC	Edgewood Chemical Biological Center
EDS	Explosive Destruction System
EE	Environmental Enclosure
EMT	emergency medical technician
EOC	Emergency Operations Center
EPDS	Emergency Personnel Decontamination Station
FSS	Fragment Suppression System
GB	sarin
GD	soman
HAZWOPER	Hazardous Waste Operations and Emergency Response
HD	distilled sulfur mustard
HEPA	high efficiency particulate air
HT	mustard-T agent mixture
kg	kilogram
km/h	kilometer per hour
LSC	linear-shaped charge
MARB	Materiel Assessment Review Board
MCE	maximum credible event
MEA	monoethanolamine



MHE	material handling equipment
MIL-STD	Military Standard
mL	milliliter
MSDS	Material Safety Data Sheet
NaOH	sodium hydroxide
NEC	National Electrical Code
NEW	net explosive weight
NIOSH	National Institute for Occupational Safety and Health
NRT	near real-time
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PDS	Personnel Decontamination Station
PEL	permissible exposure limit
PMCD	Program Manager for Chemical Demilitarization
PMNSCM	Project Manager for Non-Stockpile Chemical Materiel
PPE	personal protective equipment
psig	pounds per square inch gauge
RCRA	Resource Conservation and Recovery Act
RDT&E	research development, test, and evaluation
RDX	cyclonite
RMD	Risk Management Directorate
RMO	Risk Management Office
ROPS	rollover protection system
RPD	respiratory protective device

SAR	supplied-air respirator
SCBA	self-contained breathing apparatus
SHERP	Safety, Health, and Emergency Response Plan
SHO	Safety and Health Officer
SOP	Standing Operating Procedure
STEL	short-term exposure limit
TB	Technical Bulletin
TLV	Threshold Limit Value
USC	United States Code
VX	O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate
WGBT	Wet-Bulb Globe Temperature
WPL	worker population limit

**APPENDIX I-2**  
**CHEMICAL LIST**

## **APPENDIX I-2**

### **CHEMICAL LIST**

In accordance with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.1200(g)(8), Material Safety Data Sheets (MSDSs) are required for each hazardous chemical and will be readily accessible during each work shift to employees when they are in their work area(s) (see **Table I-2-1**).

In accordance with OSHA Standard 29 CFR 1910.1200(g)(7), MSDSs are not required to be available when household consumer products are used in the workplace in the same manner as a consumer would use them. MSDSs for consumer products are provided as a courtesy to employees using these products (see **Table I-2-2**).

Table I-2-1. Required MSDSs

Item	Part Number/ Vendor Number	Source	Intended Use
Acetic Acid (Vinegar)	N/A	Local Purchase	Vessel rinse
ASZM TEDA 12-30 Mesh Fill	Unisorb Dwg# 981208	Unisorb	Vapor filtration
Ethyl Acetate (99.5+%)	N/A	Aldrich Chemical Co., Inc. (Chemical Supplier)	Remove Perma-Slik <sup>®</sup> lubricant
EBW Detonator (for Conical- and Linear-Shaped Charge)	188-7344	Reynolds	Munitions destruction
Fluorolube Grease	N/A	Chemical Supplier	Lubricating pressure gauge fittings
Fluorolube Oil	N/A	Chemical Supplier	Damping pressure gauge to eliminate erratic readings
GB	N/A	N/A	CWM destruction
GD	N/A	N/A	CWM destruction
Helium Pressurized Gas, 150 mL Canister, 140 psig	N/A	Industrial Gas Supplier	Leak detector testing
Helium Purity, Compressed, 99.99%	N/A	Industrial Gas Supplier	Vessel leak calibration
Hexane	N/A	N/A	Calibration of HD in MINICAMS <sup>®</sup>
HD	N/A	N/A	CWM destruction
HT	N/A	N/A	CWM destruction
Hydrogen, Compressed	N/A	Industrial Gas Supplier	Monitoring
Shaped Charge (Linear and Conical)	N/A	Accurate Energetic Systems, LLC	Munitions destruction
MEA	N/A	Chemical Supplier	Reagent

Table I-2-1. Required MSDSs (Continued)

Item	Part Number/ Vendor Number	Source	Intended Use
NaOH	N/A	Chemical Supplier	Reagent
Nitrogen, 99.999%	N/A	Industrial Gas Supplier	GC/MSD and MINICAMS
Perma-Slik <sup>®</sup> RAC (10-137)	No vendor # - order by item name	EM	Vessel seal lubricant
Sodium Hypochlorite Solution (bleach 5.25% nominal)	N/A	Local Purchase	General purpose decontaminant
TRACIT-300	N/A	N/A	N/A
VX	N/A	N/A	CWM destruction
Zero-grade Air	N/A	N/A	MINICAMS

Notes:

CWM = chemical warfare materiel  
 EBW = exploding bridge-wire  
 GB = sarin  
 GC/MSD = gas chromatograph/mass selective detector  
 GD = soman  
 HD = distilled sulfur mustard  
 HT = thickened mustard  
 MEA = monoethanolamine  
 mL = milliliter  
 N/A = not applicable  
 NaOH = sodium hydroxide  
 psig = pounds per square inch gauge

Table I-2-2. MSDSs on Consumer Products

Item	Part Number/ Vendor Number	Source	Intended Use
Alcatel Leak Detector Oil			
Boelube	70200-13	The Orelube Corp.	Lube valve fittings on vessel
Conax Lubricant w/Brush	N/A	Conax Buffalo Technologies	Lubricate feedthrough sealing glands
Fluorescent Paint, Orange	N/A	Local Purchase	Mark FSS
Grease, Multipurpose	N/A	Local Purchase	Grease fittings
Hydra oil, Wanner (EPMD-F/G 20W)	A01-114-3407	Wanner Engineering	Lubricate supply pump
Loctite® Sealant	N/A	Local Purchase	Nuts and bolts
Mobil DTE 25 Hydraulic Oil	N/A		
Mobilux EP 1	Mobil DTE 25	Mobil Oil Corp.	Hydraulic System and Tensioner Pump
Oil, 10W30	N/A	Local Purchase	Coleman Powermate Compressor
Pneumatic Lubricating Oil	AD 220	Gast Mfr Corp	Lubricate air driven drum pump and double diaphragm air pump
Silica Gel	N/A	Chemical Supplier	Moisture absorbent
Silicone Spray	N/A	CRC®	Lubricant
Silicone Spray	N/A	GUNK®	Lubricant
Starter Fluid	N/A	Mac's	Diesel Generator
Transmission Fluid (Dextron II)			
Vacuum Grease, Dow Corning	1204K52 (5.3 oz) 1204K58 (8 lbs)	McMaster Carr	Used to lubricate seals
Vacuum Pump Fluid (oil)	1099	Alcatel Vacuum Products, Inc.	Used for vacuum pump and leak detector
WD-40® Aerosol	N/A	Local purchase	General purpose lubricant

Notes:

FSS = Fragment Suppression System  
N/A = not applicable

## **APPENDIX I-3 REFERENCES**



## **APPENDIX I-3**

### **REFERENCES**

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**APPENDIX I-4**  
**BACKGROUND INFORMATION/RELATED PUBLICATIONS**

## **APPENDIX I-4**

### **BACKGROUND INFORMATION/RELATED PUBLICATIONS**

American Conference of Government Industrial Hygienists, *The Guide to Occupational Exposure Values*, Current Edition.

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## **APPENDIX I-5**

### **HEAT STRESS GUIDELINES**



**APPENDIX I-5-1**  
**HEAT STRESS GUIDELINES**

## **APPENDIX I-5-1**

### **HEAT STRESS GUIDELINES**

#### **I-5.1.1 Heat Stress Threshold Limit Values (TLVs) and Action Limits**

The heat stress TLVs and action limits specified in **Tables I-5-1-1** and **I-5-1-2**, respectively, refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs are based on the assumption that nearly all adequately hydrated, unmedicated, healthy, acclimatized workers should be able to function effectively under the given working conditions without exceeding a body core temperature of 38°C (100.4°F). **Table I-5-1-1** identifies screening criteria for TLVs for heat stress exposure. Action limits are used to determine a heat stress management program, similar to TLVs, for unacclimatized workers. **Table I-5-1-2** identifies the screening criteria for Action Limits for heat stress exposure. The work load categories used in **Tables I-5-1-1** and **I-5-1-2** (Light, Moderate, etc.) are defined in paragraph I-5.1.5.

Where there is a requirement for protection against other harmful substances in the work environment and additional personal protective clothing and equipment must be worn, a correction to the Wet Bulb Globe Temperature (WBGT) TLV values must be applied.

#### **I-5.1.2 Definitions**

- Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress.
- Heat stress is the net load to which a worker may be exposed from the combined contributions of metabolic cost of work, environmental factors

Table I-5-1-1. Screening Criteria for TLVs for Heat Stress Exposure  
(WBGT values in °C)

Allocation of Work in a Cycle of Work and Recovery	Work Load (°C)			
	Light	Moderate	Heavy	Very Heavy
75% to 100%	31.0	28.0	--	--
50% to 75%	31.0	29.0	27.5	--
25% to 50%	32.0	30.0	29.0	28.0
0% to 25%	32.5	31.5	30.5	30.0

Table I-5-1-2. Screening Criteria for Action Limits for Heat Stress Exposure  
(WBGT values in °C)

Allocation of Work in a Cycle of Work and Recovery	Work Load (°C)			
	Light	Moderate	Heavy	Very Heavy
75% to 100%	28.0	25.0	--	--
50% to 75%	28.5	26.0	24.0	--
25% to 50%	29.5	27.0	25.5	24.5
0% to 25%	30.0	29.0	28.0	27.0

(air temperature, humidity, air movement, and radiant heat exchange), and clothing requirements. Mild or moderate heat stress may cause discomfort and may adversely affect performance and safety, but it is not harmful to health. As the heat stress approaches human tolerance limits, the risk of heat-related disorders (such as heat exhaustion and heat cramps) increases.

- Heat strain is the overall physiological response resulting from heat stress. The physiological adjustments are dedicated to dissipating excess heat from the body.
- Heat stroke is a severe condition caused by impairment of the body's temperature-regulating abilities. It is a result of prolonged exposure to excessive heat. Symptoms include the cessation of sweating, severe headache, high fever, hot and dry skin, and in serious cases, collapse and coma. It can cause death or permanent disability if immediate emergency treatment is not given.
- Metabolic rate is the speed at which the body uses energy.
- WBGT is an index used to quantify the true level of heat stress on an individual from the combined effects of air temperature, humidity, air movement, and radiated heat.
- Workload is the amount of work assigned to or expected from a worker in a specified time period.

### I-5.1.3 Screening Threshold Based on WBGT

**Tables I-5-1-1** and **I-5-1-2** provide WBGT criteria suitable for screening purposes to determine a threshold for heat stress management actions. As work demands increase, the criteria values in **Tables I-5-1-1** and **I-5-1-2** decrease to ensure that most workers will not experience a core body temperature above 38°C (100.4°F). To determine the correct category of workload to use in this analysis, see paragraph I-5.1.5. If, while using these criteria, there are reports of symptoms of heat-related disorders including fatigue, nausea, dizziness, and lightheadedness, then the temperature levels the worker is exposed to should be reconsidered.

The measurement of environmental factors is required for monitoring the workers' heat load because it is impractical to determine body core temperature. These environmental factors most nearly correlate with body core temperature and other physiological responses to heat. At the present time, the WBGT is the most suitable technique to measure the environmental factors. WBGT values are calculated by the following equations:

- a. With direct exposure to sunlight:

$$\text{WBGT}_{\text{out}} = 0.7 T_{\text{nwb}} + 0.2 T_{\text{g}} + 0.1 T_{\text{db}}$$

- b. Without direct exposure to the sun:

$$\text{WBGT}_{\text{in}} = 0.7 T_{\text{nwb}} + 0.3 T_{\text{g}}$$

where: WBGT = Wet Bulb Globe Temperature  
 $T_{\text{nwb}}$  = Natural Wet Bulb Temperature (sometimes called NWB)  
 $T_{\text{g}}$  = Globe Temperature (sometimes called GT)  
 $T_{\text{db}}$  = Dry-Bulb (air) Temperature (sometimes called DB).

The determination of WBGT values requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer.

Higher heat exposures than those shown in **Table I-5-1-1** are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant to work in heat than the average worker. For those medically permitted and acclimatized workers, the body core temperature shall not exceed 38.5°C (101.3°F). For unacclimatized workers who have not been deemed medically permissible, the body core temperature shall not exceed 38°C (100.4°). If the temperatures are exceeded in either of these cases, the worker's exposure to heat stress should be discontinued immediately and medical treatment sought if required.

#### **I-5.1.4 Evaluation and Control**

**I-5.1.4.1 Measurement of the Environment.** The instruments required are a dry-bulb thermometer, a natural wet-bulb thermometer, a globe thermometer, and a stand. The measurement of the environmental factors should be performed as follows.

The range of the dry and the natural wet-bulb thermometer should be -5° to +50°C (23° to 122°F) with an accuracy of  $\pm 0.5^\circ\text{C}$  ( $\pm 0.5^\circ\text{F}$ ). The dry-bulb thermometer must be shielded from the sun and other radiant surfaces of the environment without restricting airflow around the bulb. The wick of the natural wet-bulb thermometer should be kept wet with distilled water for at least 30 minutes before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillary action. The wick should be wetted by direct application of water from a syringe 30 minutes before each reading. The wick should extend over the bulb of the thermometer, covering the stem by approximately one additional bulb length. The wick should always be clean and new wicks should be washed before using.

A globe thermometer, consisting of a 15-centimeter (6-inch) diameter hollow copper sphere painted on the outside with a matte black finish or equivalent, should be used. The bulb or sensor of a thermometer (range  $-5^{\circ}$  to  $+100^{\circ}\text{C}$  [ $23^{\circ}$  to  $212^{\circ}\text{F}$ ] with an accuracy of  $\pm 0.5^{\circ}\text{C}$  [ $\pm 0.5^{\circ}\text{F}$ ]) must be fixed in the center of the sphere. The globe thermometer should be exposed to the work or rest environment for at least 25 minutes before it is read.

A stand should be used to suspend the three thermometers so that they do not restrict free airflow around the bulbs, and so the wet-bulb and globe thermometers are not shaded.

It is permissible to use any other type of temperature sensor that gives a reading identical to that of a mercury thermometer under the same conditions.

The thermometers must be placed so that the readings are representative of the conditions under which the employees work or rest, respectively.

#### **I-5.1.5 Work Load Categories**

Heat produced by the body and the environment, together, determine the total heat load. Therefore, if work is to be performed under hot environmental conditions, the workload category of each job should be established and the heat exposure limit pertinent to the workload should be evaluated against the applicable standard to prevent worker exposure beyond the permissible limit.

The workload category may be established by ranking each job into resting, light, medium, heavy, or very heavy categories on the basis of operation type:

- *Resting.* For example, sitting quietly, or sitting with moderate arm movements.

- *Light Work.* For example, sitting with moderate arm and leg movements, standing with light work at machine or bench while using mostly arms, using a table saw, or standing with light or moderate work at machine or bench and some walking about.
- *Moderate Work.* For example, scrubbing in a standing position, walking about with moderate lifting or pushing, walking on level at 6 kilometers per hour (km/hr) while carrying a 3-kilogram (kg) weight load.
- *Heavy Work.* For example, a carpenter sawing by hand, shoveling dry sand, heavy assembly work on a noncontinuous basis, or intermittent heavy lifting with pushing or pulling, like pick or shovel work.
- *Very Heavy Work.* For example, shoveling wet sand.

Where the workload is ranked into one of the previously mentioned five categories, the permissible heat exposure TLV and action limit for each workload can be estimated from **Tables I-5-1-1** and **I-5-1-2**.

The TLVs for continuous work are applicable where there is a work-rest regimen of a 5-day workweek and an 8-hour workday with a short morning and afternoon break (approximately 15 minutes) and a longer lunch break (approximately 30 minutes). Higher exposure values are permitted if additional resting time is allowed. All breaks, including unscheduled pauses and administrative or operational waiting periods during work, may be counted as rest time when additional rest allowance must be given because of high environmental temperatures.



### **I-5.1.6 Guidelines for Limiting Heat Strain**

Monitoring signs and symptoms of heat-stressed workers is sound industrial hygiene practice, especially when clothing may significantly reduce the ability to lose body heat. For surveillance purposes, a pattern of workers exceeding the TLV limits is indicative of a need to control the exposures. On an individual basis, the TLV limits represent a time to cease an exposure until recovery is complete.

Excessive heat strain may be marked by one or more of the following measures, and an individual's exposure to heat stress should be discontinued when any of the following occur:

- Sustained (several minutes) heart rate is in excess of 180 beats per minute (bpm) minus the individual's age in years ( $180 - \text{age}$ ), for individuals with assessed normal cardiac performance.
- Body core temperature is greater than  $38.5^{\circ}\text{C}$  ( $101.3^{\circ}\text{F}$ ) for medically selected and acclimatized personnel; or greater than  $38^{\circ}\text{C}$  ( $100.4^{\circ}\text{F}$ ) in unselected, unacclimatized workers.
- Recovery heart rate at one minute after a peak work effort is greater than 120 bpm.
- There are symptoms of sudden and severe fatigue, nausea, dizziness, or lightheadedness.

An individual may be at greater risk if:

- Profuse sweating is sustained over hours.

- Weight loss over a shift is greater than 1.5 percent of body weight.
- 24-hour urinary sodium excretion is less than 50 mmoles.

If a worker appears to be disoriented or confused, or suffers inexplicable irritability, malaise, or flu-like symptoms, the worker should be removed from heat for rest in a cool location with rapidly circulating air and kept under skilled observation. Immediate emergency care may be necessary. If sweating stops and the skin becomes hot and dry, immediate emergency care with hospitalization is essential.

#### **I-5.1.7 Water and Salt Supplementation**

During the hot season or when the worker is exposed to artificially generated heat, drinking water should be made available to the workers in such a way that they are stimulated to frequently drink small amounts, one cup every 20 minutes (about 150 milliliters [mL] or 1/4 pint).

The water should be kept reasonably cool, 10° to 15°C (50° to 60°F), and should be placed close to the workplace so that the worker can reach it without abandoning the work area.

The workers should be encouraged to salt their food well during the hot season and particularly during hot spells; however, those on a salt-restricted diet should check with their doctor first. If the workers are unacclimatized, salted drinking water should be made available in a concentration of 0.1 percent (1 gram salt to 1.0 liter or 1 level tablespoon of salt to 15 quarts of water). The added salt should be completely dissolved before the water is distributed, and the water should be kept reasonably cool.

It is unwise to consume beverages such as cola, iced tea, and coffee while working in a hot work environment because they contain caffeine. Caffeine is a diuretic, meaning it

increases urination. These drinks cause your kidneys to pull more water out of the bloodstream even as the digestive system is pulling water into the body, so hydration is occurring very slowly. Potassium can also be depleted by the use of diuretics, which could lead to heat cramps.

While water is very helpful in preventing heat-related disorders, sports drinks can also be beneficial. Sports drinks contain electrolytes, which are elements or chemicals that enable the body and heart to work properly. These are mineral salts like calcium, magnesium, potassium, and sodium and are necessary in any diet for healthy nerves and muscle movement. Sports drinks can be used to replenish these minerals that can be depleted during physical exertion and perspiration. The good taste of sports drinks encourages hydration because individuals will continue drinking even after their thirst is quenched. Overall, water provides for maximum hydration but sports drinks add minerals vital to avoiding dehydration and heat-related disorders.

#### **I-5.1.8 Other Considerations**

**I-5.1.8.1 Clothing.** The permissible heat exposure TLVs and action limits are valid for light summer clothing (that is, long-sleeve shirt and pants) customarily worn by workers when working under hot environmental conditions. If special clothing is required for performing a particular job and this clothing is heavier, impedes sweat evaporation or has a higher insulation value, the worker's heat tolerance is reduced, and the screening criteria for heat stress exposure indicated in **Tables I-5-1-1** and **I-5-1-2** are not applicable and corrections must be applied.

**Table I-5-1-3** identifies the additions to WBGT values (°C) in **Tables I-5-1-1** and **I-5-1-2** for different types of clothing ensembles. These values should not be used for encapsulating suits or garments that are impermeable or highly resistant to water vapor or air movement through fabrics.

Table I-5-1-3. Additions to Measured WBGT Values (°C) for Some Clothing Ensembles

Clothing Type	WBGT Addition
Summer Work Uniform	0
Cloth (Woven Material) Coveralls	0
Double-Layer Woven Clothing	3
SMS Polypropylene Coveralls	0.5
Polyolefin Coveralls	1
Limited-Use Vapor-Barrier Coveralls	11

**Figure I-5-1-1** is a decision-making process that provides guidance for heat stress management. It illustrates the steps to take depending on clothing worn and the results of detailed analysis.

**I-5.1.8.2 Acclimatization and Fitness.** Acclimatization to heat involves a series of physiological and psychological adjustments that occur in an individual during the first weeks of exposure to hot environmental conditions. The recommended heat stress exposures are valid for acclimated workers who are physically fit. Extra caution must be employed when unacclimatized or physically unfit workers must be exposed to heat conditions. Full heat acclimatization requires up to 3 weeks of continued physical activity under heat stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat stress conditions is discontinued. A noticeable loss occurs after 4 days, and a permanent loss occurs after 3 to 4 weeks. A worker can be considered acclimatized after exposure of at least 2 hours per day for 5 of the last 7 days in the work environment for the purpose of **Tables I-5-1-1** and **I-5-1-2**.

**I-5.1.8.3 Adverse Health Effects.** The most serious heat-induced illness is heat stroke because of its potential to be life threatening or result in irreversible damage. Heat stroke occurs when the body's thermoregulation has been overwhelmed and has lost all

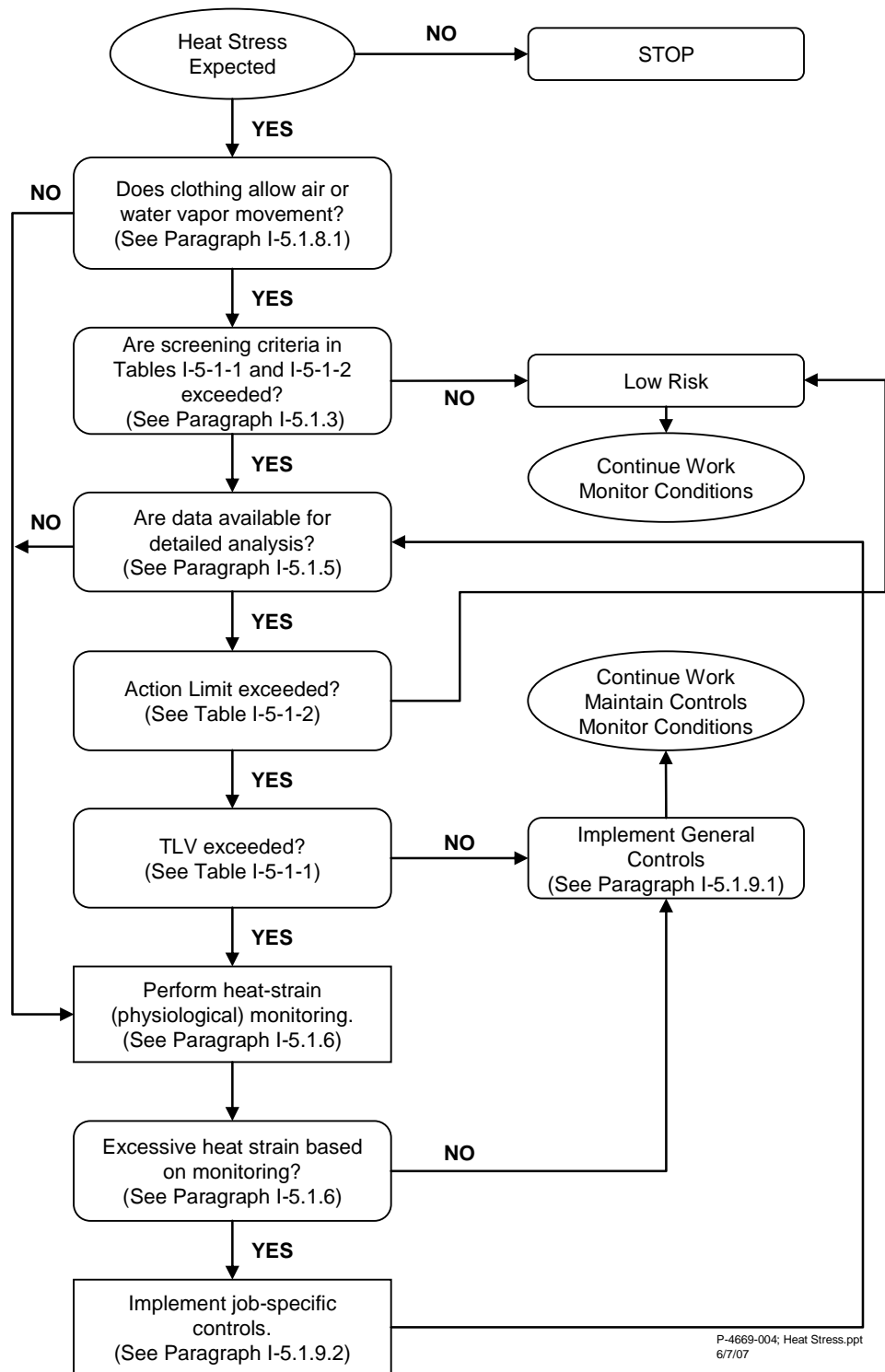


Figure I-5-1-1. Evaluation Scheme for Heat Stress

of its major defenses against hyperthermia. Symptoms of heat stroke include becoming manic, disoriented, confused, delirious, or losing consciousness. Also, the skin may become hot and dry and sweating will stop. If body core temperature rises to greater than 40°C (104°F), immediate emergency care and hospitalization are essential. If heat stroke is suspected, immediately remove the victim from the heat, and cool them rapidly using whatever method possible, including immersing in a tub of cool water, placing in a cool shower, or spraying with cool water from a garden hose.

Other heat-induced illnesses include heat exhaustion, which, in its most serious form, leads to prostration and can cause serious injuries as well. Heat cramps, while debilitating, are easily reversible if properly and promptly treated. Heat disorders due to excessive heat exposure include electrolyte imbalance, dehydration, skin rashes, heat edema, and loss of physical and mental work capacity. Guidelines for managing heat stress are outlined in paragraph I-5.1.9 of this document.

If during the first trimester of pregnancy, a female worker's core temperature exceeds 39°C (102.2°F) for extended periods, there is an increased risk of malformation to the unborn fetus. Additionally, core temperatures above 38°C (100.4°F) may be associated with temporary infertility in both females and males.

#### **I-5.1.9 Guidelines for Heat Stress Management and Controls**

Heat stress (for example, WBGT Screening Criteria in **Tables I-5-1-1** and **I-5-1-2**) and heat strain (paragraph I-5.1.6) should be monitored to confirm adequate condition of workers. It is necessary to implement a heat stress management program when either heat stress levels exceed the criteria in **Tables I-5-1-1** and **I-5-1-2**, or work clothing limits heat loss. General controls are warranted in either case, and appropriate job-specific controls are often required to ensure adequate protection. The following are guidelines for heat stress management.

#### **I-5.1.9.1 General Controls.**

- Provide accurate verbal and written instructions, frequent training programs, and other information about heat stress and strain.
- Encourage drinking small volumes (approximately 1 cup) of cool, palatable water or sports drinks about every 20 minutes.
- Permit self-limitation of exposures and encourage co-worker observation to detect signs and symptoms of heat strain in others.
- Counsel and monitor those who take medications that may compromise normal cardiovascular blood pressure, body temperature regulation, renal, or sweat gland functions; and those who abuse or are recovering from the abuse of alcohol or other intoxicants.
- Encourage healthy life-styles, ideal body weight, and electrolyte balance.
- Adjust expectations of those returning to work after absence from hot exposure situations and encourage consumption of salty foods (with approval of physician if on a salt-restricted diet).
- Consider pre-placement medical screening to identify those susceptible to systemic heat injury.
- Monitor condition and report any heat-related illness.

#### **I-5.1.9.2 Job-Specific Controls.**

- Consider engineering controls that reduce the metabolic rate, provide general air movement, reduce process heat and water-vapor release, and shield radiant heat sources, among others.
- Consider administrative controls that set acceptable exposure times, allow sufficient recovery, and limit physiological strain.
- Consider personal protection that is demonstrated effective for the specific work practices and conditions at the location.

**Never** ignore signs or symptoms of heat-related illnesses.



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**APPENDIX I-5-2**  
**ARMY HEAT STRESS MEDICAL SCREENING GUIDELINES**

## **APPENDIX I-5-2**

### **ARMY HEAT STRESS MEDICAL SCREENING GUIDELINES**

The Army Chemical Agent Program screening physical examination is designed for workers who have not been employed in areas exposed to heat extremes. It should be assumed that such individuals are not acclimatized to work in hot climates. The physician should obtain the following information.

- A medical history that addresses the cardiovascular, respiratory, neurological, renal, hematological, gastrointestinal, and reproductive systems and includes information on specific dermatological, endocrine, connective tissue, and metabolic conditions that might affect heat acclimatization or the ability to eliminate heat
- A complete occupational history, including years of work in each job, the physical and chemical hazards encountered, the physical demands of these jobs, intensity and duration of heat exposure, and non-occupational exposures to heat and strenuous activities. The history should identify episodes of heat-related disorders and evidence of successful adaptation to work in heat environments as part of previous jobs or in non-occupational activities.
- A list of all prescribed and over-the-counter medications used by the worker. In particular, the physician should consider the possible impact of medications that potentially can affect cardiac output, electrolyte balance, renal function, sweating capacity, or autonomic nervous system function. Examples of such medications include diuretics, antihypertensive drugs, sedatives, antispasmodics, anticoagulants, psychotropic medications, and

drugs that alter the thirst (haloperidol) or sweating mechanism (phenothiazines, antihistamines, and anticholinergics).

- Information about personal habits, including the use of alcohol and other social drugs
- Data on height, weight, gender, and age.

The direct evaluation of the worker should include the following:

- Physical examination, with special attention to the skin and cardiovascular, respiratory, musculoskeletal, and nervous systems
- Clinical chemistry values needed for clinical assessment, such as fasting blood glucose, blood urea nitrogen, serum creatinine, serum electrolytes (sodium, potassium, chloride, bicarbonate), hemoglobin, and urinary sugar and protein
- Blood pressure evaluation
- Assessment of the ability of the worker to understand the health and safety hazards of the job, understand the required preventive measures, communicate with fellow workers, and have mobility and orientation capacities to respond properly to emergency situations.

**APPENDIX I-5-3**  
**EDGEWOOD CHEMICAL BIOLOGICAL CENTER**  
**HEAT STRESS PLAN FOR USE OF**  
**CHEMICAL PROTECTIVE CLOTHING**  
**21 JUNE 2006**



DEPARTMENT OF THE ARMY  
US ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND  
EDGEWOOD CHEMICAL BIOLOGICAL CENTER  
5183 BLACKHAWK ROAD  
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REPLY TO  
ATTENTION OF

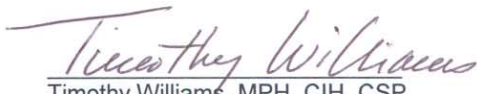
AMSRD-ECB-CCB-CR


21 June 2006


MEMORANDUM FOR RECORD

SUBJECT: ECBC Heat Stress Plan for Use of Chemical Protective Clothing

1. The attached ECBC Heat Stress Plan for Use of Chemical Protective Clothing has been reviewed, evaluated, and approved by the ECBC Risk Reduction Office, and the Competent Medical Authority, Kirk U.S. Army Health Clinic.
2. The Heat Stress Plan is in effect from the date of this memorandum for record.
3. The point of contact for ECBC is Mr. Timothy Williams, Master Industrial Hygienist, Risk Reduction Office, DSN 584-2302.

  
Timothy Williams, MPH, CIH, CSP  
Master Industrial Hygienist  
ECBC Risk Reduction Office

  
Emory J. Linder, M.D.  
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7/24a

**EDGEWOOD CHEMICAL BIOLOGICAL CENTER  
HEAT STRESS PROGRAM  
FOR THE USE OF  
IMPERMEABLE CHEMICAL PROTECTIVE CLOTHING**

**THE EDGEWOOD CHEMICAL BIOLOGICAL CENTER  
RISK REDUCTION OFFICE**

**Prepared by:**

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**EDGEWOOD CHEMICAL BIOLOGICAL CENTER**  
**HEAT STRESS PROGRAM**  
**FOR THE USE OF**  
**IMPERMEABLE CHEMICAL PROTECTIVE CLOTHING**

1. **PURPOSE.** These guidelines are designed to minimize the occurrence of heat stress injuries and illnesses at ECBC and possibly extend stay times by monitoring the physiological signs of heat stress in workers wearing vapor impermeable, chemical protective clothing.
2. **SCOPE.** These guidelines apply to all personnel wearing vapor impermeable, chemical protective clothing (CPC) when ambient temperatures are at or above 70°F<sup>8.1</sup> in laboratories, environmental chambers, commercial, industrial, and hazardous waste remediation operations. An exception is made for personnel covered by another site/operation specific heat stress plan.
3. **DEFINITIONS.**
  - 3.1 *Maximum Continuous Work Time.* The amount of time that a worker can continuously work before the variables of environmental conditions, metabolic rates, and the level of personal protective equipment worn dictate that rest is necessary to prevent physiological illness or injury. Body core temperature (or equivalent) and heart rate are used to determine the maximum continuous work time by an employee's physiological signs remaining within the parameters prescribed below under **WORKPLACE LIMITS AND SURVEILLANCE**.
  - 3.2 *Rest, Rehydration and Cooling Period.* All work periods should be followed by a rest, rehydration, and cooling period. During the rest, rehydration and cooling period, the workers must be removed from the heat stressful environment to a climate-controlled environment with a temperature range between 68 and 79 degrees Fahrenheit<sup>8.2</sup>; take off protective masks, gloves, boots, aprons or butyl suits; and consume approximately 1 quart of cool (50-60 degree F optimally) water or electrolyte supplemented sport drinks (e.g., Gatorade) to replace fluids lost during the work period. Workers should not consume more than 1.5 quarts per hour or 12 quarts per day to avoid water intoxication.<sup>8.3</sup>
  - 3.3 *Acclimatization* refers to the physiological changes that the body undergoes in order to adjust to the hotter than normal environmental conditions. Heat acclimatization occurs with substantial adaptation after eight days with as little as two hours a day of exposure.<sup>8.4</sup>



- 3.4 *Heat cramps* may occur after prolonged exposure to heat with profuse perspiration and inadequate replacement of salt. The signs and symptoms of heat cramps consist of spasm and pain in the muscles of the abdomen and extremities.
- 3.5 *Heat exhaustion* may result from physical exertion in a hot environment when vasomotor control and cardiac output are inadequate to meet the increased demand placed upon them by peripheral vasodilation or the reduced plasma volume from dehydration. Signs and symptoms of heat exhaustion may include pallor, weakness, dizziness, difficulty in breathing, profuse sweating, and cool, moist skin.
- 3.6 *Heat stroke* is a true medical emergency and is due to the collapse of the individual's temperature control system. An important predisposing factor is excessive physical exertion. In this condition the core temperature can easily exceed 106 degree Fahrenheit and it is imperative that the body temperature be lowered as quickly and rapidly as possible to prevent permanent damage. Another unique issue in heat stroke is that it is believed that once it occurs similar environmental condition in the future will cause it to happen again so future monitoring is very important. Signs and symptoms may include dizziness, nausea, severe headache, hot dry skin because of cessation of sweating, very high body temperature (usually 106 degrees Fahrenheit and rising), confusion, collapse, delirium, and coma. Often circulation is compromised to the point of shock.<sup>8,7</sup>

#### 4. RESPONSIBILITIES.

##### 4.1 Installation Medical Authority (IMA) will:

- 4.1.1 Grant permission to extend stay times beyond those specified in DA-PAM 385-61.<sup>8,5</sup>
- 4.1.2 Evaluate employees to determine fitness for duty in heat stressful environments.
- 4.1.3 Re-evaluate employees to determine continued fitness for duty in heat stressful environments on an annual basis.
- 4.1.4 Provide emergency medical care.
- 4.1.5 Report to the supervisor, in writing, the fitness of that employee for working in heat stressful environments under the additional burden of fully encapsulated, vapor impermeable, chemical protective clothing. Worker limitations shall also be reported.
- 4.1.6 Maintain records of physiological monitoring.

4.2 The Site ECBC Industrial Hygienist/Site Safety Health Officer (SSHO) will:

- 4.2.1 Update the heat stress program documents as needed.
- 4.2.2 Provide a liaison with the medical community when needed.
- 4.2.3 Provide technical guidance relative to heat stress monitoring techniques and decision logic.
- 4.2.4 Provide and/or assist in characterizing environmental data (wet bulb globe temperature/dry bulb temperature/relative humidity) and workload classification.
- 4.2.5 Conduct an awareness program to inform ECBC employees about the program.
- 4.2.6 Provide initial and annual refresher training to workers included in the scope of the program.

4.3 Supervisors of employees wearing CPC working in heat stressful environments should:

- 4.3.1 Ensure that employees follow directions for entry and post entry monitoring protocols.
- 4.3.2 Ensure that all employees receive initial and annual medical evaluations prior to working in heat stressful environments.
- 4.3.3 Ensure that employees receive a copy of the medical evaluation provided by the EAHC.
- 4.3.4 Maintain a roster of employees who have been medically cleared to work in heat stress environments by the EAHC and forward copies to the Risk Reduction Office.
- 4.3.5 Ensure that all personnel have received initial and annual refresher training before working in a heat stressful environment.
- 4.3.6 Maintain a roster of employees who have are currently trained for work in heat stress environments and forward copies to the Risk Reduction Office.
- 4.3.7 Ensure that records of physiological monitoring are forwarded to the Edgewood Area Health Clinic for inclusion into medical records.

4.4 Employees are responsible for:

- 4.4.1 Employees will complete Standard Form number 78 Certificate of Medical Examination and present to occupational health personnel when reporting for medical clearance evaluations. (see Appendix D)
- 4.4.2 Monitoring themselves for signs and symptoms of heat stress and exiting the work site in accordance with approved procedures when necessitated by heat stress.
- 4.4.3 Monitoring coworkers for signs and symptoms of heat stress and assisting coworkers with exiting the work site in accordance with approved procedures when necessitated by heat stress.
- 4.4.4 Remaining hydrated and encouraging coworkers to hydrate.

## 5. WORKPLACE LIMITS AND SURVEILLANCE

- 5.1 When wearing commercial chemical protective clothing, the employee may self determine that they are near their limit and need to exit the area based on their own sense of heat stress. The employee may not self determine lengthening the stay time past those criteria listed in paragraph below. They shall inform their co-workers of their need to leave the work area and at least one co-worker shall accompany the heat-stressed individual.
- 5.2 When working under the conditions specified in the scope of this program, workers will be monitored in accordance with the American Conference of Governmental Industrial Hygienists (ACGIH's) personal monitoring criteria.<sup>8,6</sup> Excessive heat strain is identified by the following criteria and an individual's exposure to a heat stressful environment should be discontinued when any one of the following occur:
  - 5.2.1 Causes a worker's sustained heart rate to exceed 180 minus age beats per minute (bpm)(see Appendix C); or
  - 5.2.2 Causes an unacclimatized worker's deep body temperature to exceed 38C (100F); or
  - 5.2.3 Causes an acclimatized worker's deep body temperature to exceed 38.5C (101.3F); or
  - 5.2.4 A worker experiences profuse and prolonged sweating; or
  - 5.2.5 In conditions of regular daily exposure to the stress, 24-hour urinary sodium excretion is less than 50 mmoles; or



5.2.6 For the group if there are complaints of sudden and severe fatigue, nausea, dizziness, or lightheadedness.

5.2.7 The recovery heart rate at 1 minute after peak work effort is greater than 110 beats per minute.

5.3 Personnel shall employ a buddy system and inquire about each other's health frequently to be aware of heat stress symptoms. Standby personnel shall communicate frequently with personnel wearing CPC to evaluate them for signs of heat stress.

5.4 Monitoring Log.

5.4.1 Logs of each employee's pulse rate and body core temperature (or equivalent) before, during, and after working in a heat stressful environment will be maintained. Medical personnel or an Emergency Medical Technician can monitor the heart rate and body core temperature (or equivalent). Alternatively, personnel may be monitored using electronic heart rate and core body temperature (or equivalent) devices with datalogging and alarm capabilities.

5.4.2 Pre-Shift Screening. The heat stress attendant will determine if employees are fit for duty or require further evaluation by medical professionals. If one or more of the following is answered yes, the worker is referred for medical evaluation. [NOTE: Should a worker's blood pressure exceed the screening level of 160/94, the heat stress attendant may elect to take someone's blood pressure up to three times, fifteen minutes apart, to see if resting will decrease his/her blood pressure. If it does fall below the screening level, the heat stress attendant may declare the worker fit for duty.]

5.4.3 If a worker has been referred for medical evaluation, and the medical authority finds the worker fit for duty, the medical authority will provide written notice that the employee has been evaluated and is fit for duty. Any restrictions should also be noted. The screening tool is a series of yes/no questions at the top of the log sheet in appendix A.

5.4.3.1 The attendant will use an automated or a manual sphygmomanometer (blood pressure cuff ) to determine that the worker's pulse. If the pulse is above 110 beats per minute, record the answer yes on the form.

5.4.3.2 The attendant will use an automated or manual blood pressure cuff to determine that the worker's blood

pressure is below 160/94. If either systolic (upper) of diastolic (lower) number is above the limit, record the answer yes on the form.

- 5.4.3.3 The attendant will ask the worker if they have experienced a body temperature above 100 degrees Fahrenheit in the last 24 hours. Record the answer on the form.
- 5.4.3.4 The attendant will ask the worker if they have changed any medications. Record the answer on the form.
- 5.4.3.5 The attendant will ask the worker if they have experienced vomiting and/or diarrhea in the last 24 hours. Record the answer on the form.
- 5.4.3.6 The attendant will ask the worker if they have sunburn on their body and to estimate the percentage of the body sunburned based on the "rules of 9" as depicted in Appendix E. "Excessive Sunburn" is defined as having greater than 10% of one's body surface area affected. If it is suspected that more than 10% of a person's body surface area is sunburned, record the answer yes on the log sheet. If the employee complains of being sunburned, record the answer yes on the log sheet.
- 5.4.4 Record activity level (light, moderate, heavy as defined by the American Conference of Governmental Industrial Hygienists):
  - 5.4.4.1 Light work. Sitting with moderate arm and leg movements; standing with light work at machine or bench while using mostly arms; using a table saw; standing with light or moderate work at machine or bench and some walking about.
  - 5.4.4.2 Moderate work. Scrubbing in a standing position; walking about with moderate lifting or pushing; walking on level at 6 Km/hr while carrying 3 Kg weight load.
  - 5.4.4.3 Heavy work. Carpenter sawing by hand; shoveling dry sand; heavy assembly work on a noncontinuous basis; intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work).
- 5.4.5 Record CPC Level (A, B, C) and respiratory protection used

5.4.6 Heart rates may be monitored manually or electronically with continuous data logging. The pulse rate may be recorded using a chest or wrist mounted heart rate monitor or palpating the pulse on the wrist or neck and counting beats per minute.

5.4.6.1 Manual Recording.

5.4.6.1.1 Light Work Activity: Record heart rate prior to entry, at 15 minutes after entry, and every 45 minutes thereafter with a final reading after exiting the hot environment.

5.4.6.1.2 Medium Work Activity: Record heart rate prior to entry, at 15 minutes after entry, and every 30 minutes thereafter with a final reading after exiting the hot environment.

5.4.6.1.3 Heavy Work Activity: Record heart rate prior to entry, at 15 minutes after entry, and every 15 minutes thereafter with a final reading after exiting the hot environment.

5.4.6.2 Electronic Recording with Data Logging. Personal heat stress monitoring equipment with alarm and data logging capabilities are available in the safety and health equipment marketplace. Some of these devices also provide telemetric capabilities so that personnel outside of the hot environment are able to monitor worker heat stress. Use of such devices is acceptable for physiological monitoring of worker heat stress and the printed reports from the software are acceptable for recordkeeping purposes.

5.4.6.3 Record any observation concerning signs or symptoms of heat stress for each employee.

5.4.6.4 Record time spent in heat stressful environment for each employee.

5.5 Personnel reaching the heat stress criterion shall:

5.5.1 Adjust the flow rate to the maximum setting if wearing CPC with an adjustable ventilation flow rate.

5.5.2 Sit and rest for five minutes. If the person's heart rate returns to a level below the recovery heart rate criterion (110 bpm) at the end of

five minutes, the person may resume work. If the person's heart rate is still at or above the criterion level, the person should exit the work area for rest, rehydration, and cooling.

5.6 Personnel feeling heat-related symptoms or exhibiting any heat-related signs shall exit the heat stressful environment within 5 minutes. At least one coworker shall accompany the heat-stressed individual.

5.6.1 When CPC is contaminated with highly toxic or unknown materials, the heat-stressed person should proceed with the decontamination methods addressed in the SOP provided that the person can proceed without assistance.

5.6.2 If the heat-stressed individual is so impaired as to have difficulty walking without assistance, this should be viewed as an emergency. Distressed personnel will continue to be monitored for further signs of heat stress. The health clinic and/or the on-site medical personnel will treat heat distressed personnel.

5.7 If the heat distressed person goes down in the work area and is unable to exit without assistance:

5.7.1 Standby personnel will activate the emergency medical system (EMS) by dialing 911.

5.7.2 A standby person dressed in a level of protective clothing appropriate to handle entering the work area shall assist in decontaminating and removing the distressed person from the work area. Distressed personnel will continue to be monitored for further signs of heat stress. The health clinic and/or the on-site medical personnel will treat heat distressed personnel.

## 6. Heat Abatement.

6.1 Personnel also have the option of using available heat abatement equipment (i.e. cooling vest) if they feel that further cooling is needed. The Industrial hygiene Office is available for consultation on the use of heat abatement equipment.

6.2 CPC such as the Trelchem HPS Fully Encapsulating Protective Suit can further reduce the potential for heat stress. The Trelchem HPS has an affixed ventilation system capable of circulating cooling air throughout the suit at either 30 or 100 liters per minute (LPM). During normal operations, the 30-LPM setting can be used and if the wearer begins to feel hot, the system can be set to 100 LPM. Above 84 degrees Fahrenheit, the



manufacturer recommends that the circulating air volume rate should be set at 100 LPM.

6.3 Drinking water shall be provided to personnel prior to donning CPC and after doffing of the suit. Workers shall drink water at these times to prevent dehydration.

7. Supplies and Equipment. The following items are required to record the information outlined in this plan.

7.1 Heart rate monitor, chest-mounted or wrist mounted, with digital readout. A remote radio relay model with data logging capabilities would aid in record keeping.

7.2 Drink coolers to maintain water/sport drinks in the 50 to 60 degree Fahrenheit range.

7.3 Heat Abatement devices.

7.4 Communications devices.

7.5 Automated and/or manual blood pressure cuff (syphgmomanometer).

#### 8.0 References.

8.1 Belard, J.L., Stanevich, R.L.: Overview of Heat Stress Among Waste Abatement Workers. *Applied Occupational and Environmental Hygiene* 10(11) 903-907. 1995.

8.2 ANSI/ASHRAE 55-1992: Thermal Environmental Conditions for Human Occupancy. 1992.

8.3 Latzka, Sc.D., CPT W.A., Montain, Ph.D., CPT SJ, Sawka, Ph.D., M.N.: Fluid Replacement Recommendations for Training in Hot Weather. USARIEM Technical Report T98-17. U.S. Army Research Institute of Environmental Medicine, Natick, MA =01760-5007. 1998.

8.4 Brief, R.S.: *Basic Industrial Hygiene, A Training Manual*. 189-192. New York. Exxon Corporation. 1975.

8.5 Department of Army-Pamphlet 385-61 Chemical Agent Safety Standards for H, HD, HT, L, GA, GB, and VX. Government Printing Office. 2002.

8.6 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. American Conference of Governmental Industrial Hygienists. 1999.

8.7 NIOSH Criteria, Occupational Exposure to Hot Environments: DHHS (NIOSH) Pub No 86-113. 1986.



Revision 1.0

**APPENDIX A**  
**MONITORING LOG SHEETS**

## Physiological Monitoring Log Sheet

[illegible]

**APPENDIX B**  
**SIGNS AND SYMPTOMS OF HEAT STRESS**

## Heat Stress Progression and Symptoms:

Heat cramps may occur after prolonged exposure to heat with profuse perspiration and inadequate replacement of salt. The signs and symptoms of heat cramps consist of spasm and pain in the muscles of the abdomen and extremities.

Heat exhaustion may result from physical exertion in a hot environment when vasomotor control and cardiac output are inadequate to meet the increased demand placed upon them by peripheral vasodilation or the reduced plasma volume from dehydration. Signs and symptoms of heat exhaustion may include pallor, weakness, dizziness, difficulty in breathing, profuse sweating, and cool, moist skin.

Heat stroke is a serious medical condition. An important predisposing factor is excessive physical exertion. Signs and symptoms may include dizziness, nausea, severe headache, hot dry skin because of cessation of sweating, very high body temperature (usually 106 degrees Fahrenheit and rising), confusion, collapse, delirium, and coma. Often circulation is, also, compromised to the point of shock.

**APPENDIX C**  
**SUSTAINED HEART RATE TABLE**

Revision 1.0

**Sustained Maximum Heart Rate of 180 - age Indicated a Heat Stress Condition**

Constant	Age	Max Heart Rate	Constant	Age	Max Heart Rate
	18	162			135
	19	161			134
	20	160			133
	21	159			132
	22	158			131
	23	157			130
	24	156			129
	25	155			128
	26	154			127
	27	153			126
	28	152			125
	29	151			124
	30	150			123
	31	149			122
	32	148			121
	33	147			120
	34	146			119
	35	145			118
	36	144			117
	37	143			116
	38	142			115
	39	141			114
	40	140			113
	41	139			112
	42	138			111
	43	137			110
	44	136			

Revision 1.0

**APPENDIX D**  
**STANDARD FORM NO. 78**  
**CERTIFICATE OF MEDICAL EXAMINATION (EXAMPLE)**

TO BE GIVEN TO PERSON EXAMINED WITH A PRE-ADDRESSED "CONFIDENTIAL-MEDICAL" ENVELOPE.		<b>UNITED STATES CIVIL SERVICE COMMISSION</b>		Form Approved Budget Bureau No. 50-R0073	
<b>CERTIFICATE OF MEDICAL EXAMINATION</b>					
<b>Part A. TO BE COMPLETED BY APPLICANT OR EMPLOYEE (typewrite or print in ink)</b>					
1. NAME (last, first, middle)		2. SOCIAL SECURITY ACCOUNT NO.		3. SEX <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	
4. DATE OF BIRTH		5. DO YOU HAVE ANY MEDICAL DISORDER OR PHYSICAL IMPAIRMENT WHICH WOULD INTERFERE IN ANY WAY WITH THE FULL PERFORMANCE OF THE DUTIES SHOWN BELOW? <input type="checkbox"/> YES <input type="checkbox"/> NO (If your answer is YES, explain fully to the physician performing the examination)			
6. I CERTIFY THAT ALL THE INFORMATION GIVEN BY ME IN CONNECTION WITH THIS EXAMINATION IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.		(Signature of applicant)			
<b>Part B. TO BE COMPLETED BEFORE EXAMINATION BY APPOINTING OFFICER</b>					
1. PURPOSE OF EXAMINATION <input type="checkbox"/> PREAPPOINTMENT <input checked="" type="checkbox"/> OTHER (Specify)		2. POSITION TITLE			
3. BRIEF DESCRIPTION OF WHAT POSITION REQUIRES EMPLOYEE TO DO Work in heat stressful environment wearing fully encapsulating chemical protective clothing. Work also may include contact with chemical warfare agents.					
4. Circle the number preceding each functional requirement and each environmental factor essential to the duties of this position. List any additional essential factors in the blank spaces. Also, if the position involves law enforcement, air traffic control, or fire fighting, attached the specific medical standards for the information of the examining physician.					
<b>A. FUNCTIONAL REQUIREMENTS</b>					
1. Heavy lifting, 45 pounds and over		15. Crawling (        hours)		25. Far vision correctable in one eye to 20/20 and to 20/40 in the other	
2. Moderate lifting, 15-44 pounds		16. Kneeling (        hours)		26. Far vision correctable in one eye to 20/50 and to 20/100 in the other	
3. Light lifting, under 15 pounds		17. Repeated bending (        hours)		27. Specific visual requirement (specify)	
4. Heavy carrying, 45 pounds and over		18. Climbing, legs only (        hours)		28. Both eyes required	
5. Moderate carrying, 15-44 pounds		19. Climbing, use of legs and arms		29. Depth perception	
6. Light carrying, 15-44 pounds		20. Both legs required		30. Ability to distinguish basic colors	
7. Straight pulling (        hours)		21. Operation of crane, truck, tractor, or motor vehicle		31. Ability to distinguish shades of colors	
8. Pulling hand over hand (        hours)		22. Ability for rapid mental and muscular coordination simultaneously		32. Hearing (aid permitted)	
9. Pushing (        hours)		23. Ability to use and desirability of using firearms		33. Hearing without aid	
10. Reaching above shoulder		24. Near vision correctable at 13" to 16" to Jaeger 1 to 4		34. Specif hearing requirements (specify)	
11. Use of fingers				35. Other (specify)	
12. Both hands required					
13. Walking (        hours)					
14. Standing (        hours)					
<b>B. ENVIRONMENTAL FACTORS</b>					
1. Outside		11. Silica, asbestos, etc.		20. Working on ladders or scaffolding	
2. Outside and inside		12. Fumes, smoke, or gases		21. Working below ground	
3. Excessive heat		13. Solvents (degreasing agents)		22. Unusual fatigue factors (specify)	
4. Excessive cold		14. Grease and oils		23. Working with hands in water	
5. Excessive humidity		15. Radiant energy		24. Explosives	
6. Excessive dampness or chilling		16. Electrical energy		25. Vibration	
7. Dry atmospheric conditions		17. Slippery or uneven walking surfaces		26. Working closely with others	
8. Excessive noise, intermittent		18. Working around machinery with moving parts		27. Working alone	
9. Constant noise		19. Working around moving objects or vehicles		28. Protracted or irregular hours of work	
10. Dust				29. Other (specify)	
<b>Part C. TO BE COMPLETED BY EXAMINING PHYSICIAN</b>					
1. EXAMINING PHYSICIAN'S NAME (Type or print)		5. SIGNATURE OF EXAMINING PHYSICIAN			
2. ADDRESS (including ZIP Code)		(Signature) (Date)			
		IMPORTANT: After signing, return the entire form intact in the pre-addressed "Confidential-Medical" envelope which the person you examined gave you.			

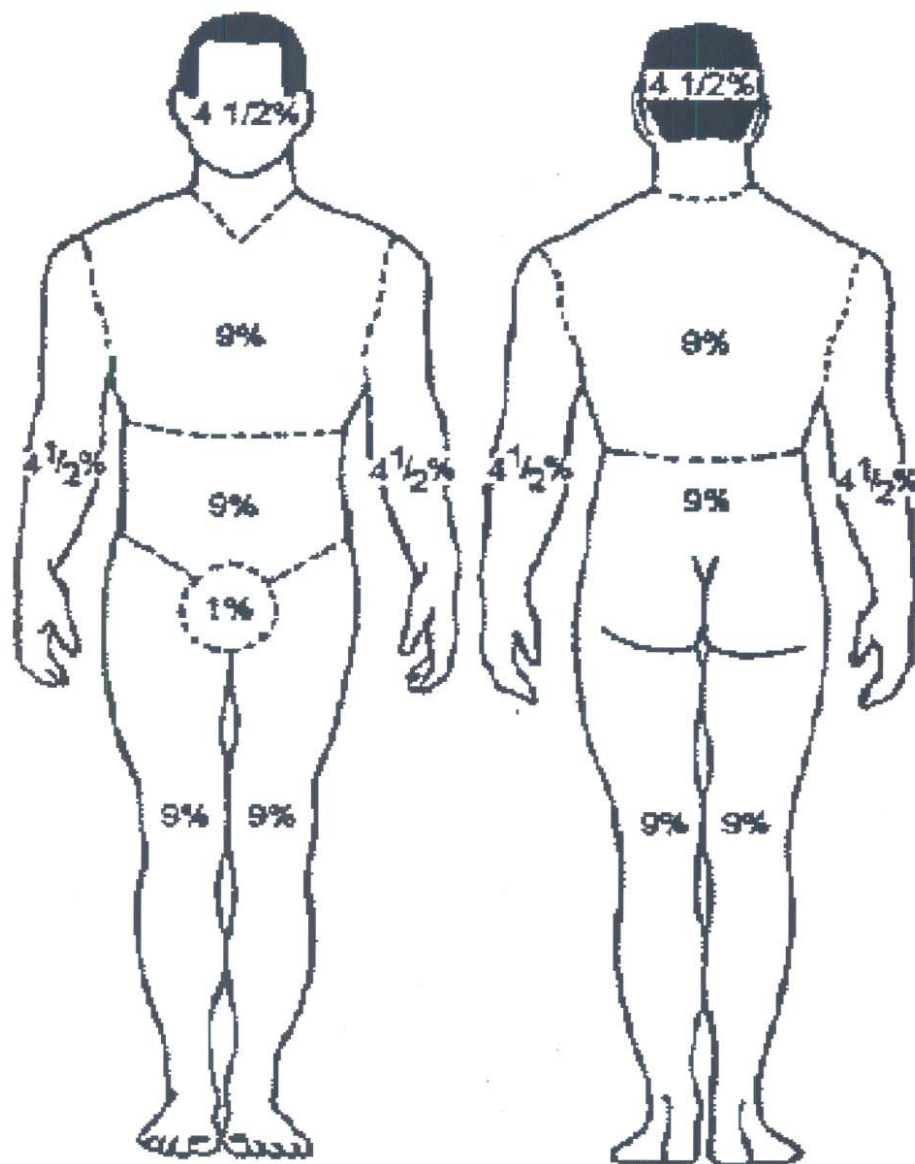
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STANDARD FORM NO. 70  
OCTOBER 1969 (REVISION)  
CIVIL SERVICE COMMISSION  
FPM 239



Revision 1.0

**APPENDIX E  
RULES OF 9  
TO  
DETERMINE PERCENT OF BODY AREA SUNBURNED**



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**APPENDIX I-6**  
**COLD STRESS GUIDELINES**

## **APPENDIX I-6**

### **COLD STRESS GUIDELINES**

#### **I-6.1 Background of Hypothermia, Frostbite, Frostnip and Trench/Immersion Foot**

Cold stress or hypothermia can affect workers who are not protected against the cold. Much like high blood pressure, hypothermia can be called a “silent killer” in the sense that many of its victims are not aware of the threat. Regardless of the ambient temperature, hot or cold, the body tries to maintain an internal (core) temperature of approximately 37°C (98.6°F).

When body temperature drops, even a few degrees below its normal temperature of 37°C (98.6°F), the body uses its defense mechanisms to help maintain its core temperature. Continuous exposure to cold will cause a person to shiver, which generates heat by speeding up the body’s metabolic rate. The body will also begin to shift blood flow away from the extremities (hands, feet, arms and legs) and outer skin to the core (chest and abdomen). This allows exposed skin and the extremities to cool rapidly and increases the risk of frostbite and hypothermia.

**I-6.1.1 Hypothermia.** Hypothermia (literally meaning “low heat”) is a condition marked by an abnormally low internal body temperature. It develops when body heat is lost to a cool or cold environment faster than it can be replaced. Temperatures do not have to be below freezing for hypothermia to occur, especially in individuals that continuously work in cold environments. Hypothermia may occur at air temperatures up to 18.3°C (65°F) or at water temperatures up to 22.2°C (72°F). Symptoms normally begin when the body temperature drops below 36°C (96.8°F). Many older adults are more susceptible to the cold and can develop a low body temperature after being exposed to mild cold conditions, which would only produce discomfort in younger people.

**I-6.1.2 Frostbite.** Frostbite is an irreversible condition in which the skin freezes, causing ice crystals to form between cells. The capillary walls of the frostbitten area are damaged, increasing cell wall permeability. Fluid is released into the tissues and is accompanied by local inflammation. The toes, fingers, nose, ears, and cheeks, are the most common sites of freezing cold injury.

**I-6.1.3 Frostnip.** Frostnip is a mild, reversible freezing of the top layers of skin tissue.

**I-6.1.4 Trench/Immersion Foot.** Trench/immersion foot is caused by continuous exposure to cold water. It may occur in wet, cold environments or through actual immersion in water. The injury generally occurs with commercial fishermen or workers who are immersed in cold water. Minor trench/immersion foot occurs after 3 to 12 hours of exposure. Severe exposure, which lasts from 12 hours to 3 days, causes significant tissue damage.

## **I-6.2 Signs and Symptoms**

The progressively appearing symptoms of hypothermia are as follows:

- a. Shivering and foot stomping, which helps generate heat.
- b. Blue lips and fingers.
- c. Poor coordination.
- d. With continued exposure to cold, the individual falls into a state of dazed consciousness, failing to complete even simple motor functions. The victim's speech may become slurred and his or her behavior may become irrational. Symptoms may also include:
  - (1) Mental impairment

- (2) Confusion
  - (3) Poor decision-making
  - (4) Disorientation
  - (5) Inability to take precautions from the cold
  - (6) Heart slowdown
  - (7) Slow breathing
- e. When the body temperature is between 25°C (77°F) and 32.2°C (90°F), shivering ceases and the individual may be unable to walk or stand.
- f. Below 25°C (77°F), there is failure of all heat regulatory and heat conservation mechanisms. The person becomes very sleepy or unconscious and death may occur at this stage. Symptoms may also include:
- (1) Unconsciousness
  - (2) Heart slowdown to the point where pulse is irregular or difficult to find
  - (3) No detectable breathing

Signs or symptoms of frostbite, which can be superficial or deep, are as follows:

- a. In superficial frostbite, the individual experiences a loss of sensation and the skin turns gray-white. Skin may appear waxy and feel numb.
- b. Deep frostbite affects the skin and the subcutaneous tissues, as well as the muscle and bone. Deep frostbite will cause numbness. The affected area will be cold, hard, and white.

Signs or symptoms of frostnip are as follows:

- a. Tingling in the extremities
- b. Sensation of heat rather than cold.

### **I-6.3 Risk Factors**

Individuals who work in a cold environment are at greatest risk for cold-induced injuries/illnesses. The United States Occupational Safety and Health Administration has listed the following as major risk factors for cold-related stresses:

- a. Wearing inadequate or wet clothing increases the effects of cold environments on the body.
- b. Taking certain drugs or medications, such as alcohol, nicotine, caffeine, and medication, that inhibit the body's response to the cold or impair judgment.



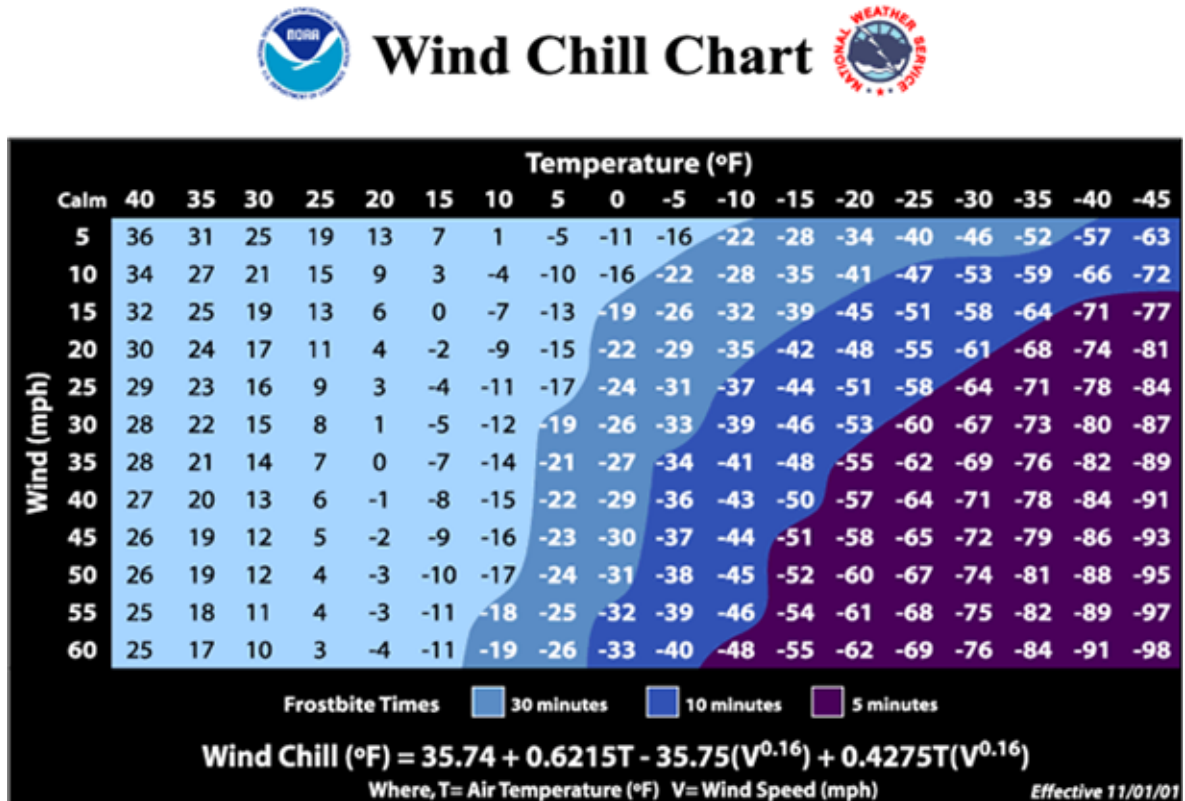
- c. Having a cold or certain diseases, such as diabetes, heart, vascular, and thyroid problems, may make a person more susceptible to the winter elements.
- d. Being male increases the risk of cold-related stresses. Men experience far greater death rates due to cold exposure than women, perhaps due to inherent risk-taking activities, body-fat composition or other physiological differences.
- e. Becoming exhausted or immobilized, especially due to injury or entrapment, may speed up the effects of cold weather.
- f. Aging – the elderly are more vulnerable to the effects of harsh winter weather.

#### **I-6.4 Controls and Precautions**

The best protection against cold-related health risks is to be aware and be prepared. Workers should recognize the signs and symptoms of overexposure in themselves and others. Pain in the extremities may be the first warning sign. Any worker shivering should come in out of the cold immediately. **Workers must be aware of and follow all of the controls and precautions listed below:**

- a. Ensure workers, especially those working out in the open, understand the wind-chill factor. See **Table I-6-1** for wind chill factors.
- b. Ensure that workers are medically fit to work in excessive cold, especially those subject to the risk factors highlighted previously.

Table I-6-1. Wind Chill Chart



- c. A person's thirst is suppressed in a cold environment and dehydration may occur when fluid intake is reduced. Since the body requires a large amount of fluids in cold weather, workers should be encouraged to drink plenty of fluids. Warm sweet drinks and soups should be arranged at the work site to maintain caloric intake and fluid volume. Alcohol and drinks containing caffeine, coffee, tea, cola, etc., should be discouraged because they increase water loss and blood flow to extremities.
- d. Make sure that workers understand the importance of high-caloric foods when working in cold environments. Recognize that workers in cold environments who wear heavy, protective clothing expend more heat than

those working in moderate climates. As a result, these workers require 10 to 15 percent more calories. Workers should ensure that caloric intake is higher when working in cold, outdoor environments.

- e. Require that personnel working in isolated cold environments, whether indoors or outdoors, have backup. Use the “buddy” system.
- f. Ensure that hot drinks and regular breaks are provided under extremely cold work conditions. The ratio of number of breaks received to number of hours worked depends on the environment (see **Table I-6-2**).

#### **I-6.4.1 Clothing.**

- a. Wear several layers of clothing rather than one thick layer. Air captured between layers acts as an insulator.
- b. Wear synthetic fabrics such as polypropylene next to the skin because these wick away sweat. Clothing should not restrict flexibility.
- c. If conditions are wet as well as cold, ensure that the outer clothing worn is waterproof or at least water-repellent. Wind-resistant fabrics may also be required under some conditions.
- d. At air temperatures of 2°C (35.6°F) or less, workers whose clothing gets wet for any reason must immediately be given a change of clothing and be treated for hypothermia.
- e. Encourage the use of hats and hoods to prevent heat loss from the head and to protect the ears, 30 percent of body heat is lost through the head.

Table I-6-2. TLVs Work/Warm-Up Schedule for Outside Workers Based on a 4-Hour Shift

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx)	°F (approx)	Max. work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease. Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2000 - page 176.	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min.	5	Non-emergency work should cease							
-43° & Below	-45° & Below	Non-emergency									

Notes:

mph = miles per hour

Source: 2006 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Adopted from Saskatchewan Labour Cold Conditions Guidelines for Outside Workers

- f. Tight-fitting footwear restricts blood flow. Footwear should be large enough to allow wearing either one thick or two thin pairs of socks. Wearing too many socks can tighten fit and harm rather than help. It is important to change socks regularly or use vapor barrier boots.
- g. Workers who get hot while working should open their jackets but keep hats and gloves on.

#### **I-6.4.2 Shelter.**

- a. For work performed continuously in the cold, at or below an equivalent chill temperature of  $-7^{\circ}\text{C}$  ( $19.4^{\circ}\text{F}$ ), allow rest and warm-up breaks. The equivalent chill temperature relates the actual dry bulb air temperature and the wind velocity. Heated shelters such as trailers should be available nearby. Encourage workers to use these shelters at regular intervals depending on wind-chill factor.
- b. Workers showing signs of shivering, frostbite, fatigue, drowsiness, irritability, or euphoria should immediately return to the shelter.
- c. Workers entering the shelter should remove their outer layer of clothing and loosen other clothing to let sweat evaporate. In some cases, a change of clothing may be necessary.

**I-6.4.3 Hand Protection.** Manual dexterity is essential to safety and productivity; however, workers must comply with the following guidelines to protect fingers and hands in cold environments.

- a. Fine work performed with bare hands for more than 10 to 20 minutes in an environment below  $16^{\circ}\text{C}$  ( $60.8^{\circ}\text{F}$ ) requires special measures to keep

workers' hands warm. These measures may include warm air jets, radiant heaters (fuel burning or electric), or contact warming plates.

- b. Metal handles of tools and control bars should be covered by thermal insulating material for temperatures below  $-1^{\circ}\text{C}$  ( $30.2^{\circ}\text{F}$ ).
- c. Workers should wear gloves where fine manual dexterity is not required and the air temperature falls below  $16^{\circ}\text{C}$  ( $60.8^{\circ}\text{F}$ ) for sedentary,  $4^{\circ}\text{C}$  ( $39.2^{\circ}\text{F}$ ) for light, and  $-7^{\circ}\text{C}$  ( $19.4^{\circ}\text{F}$ ) for moderate work.
- d. To prevent frostbite, workers should wear insulated gloves when surfaces are within reach (especially metallic surfaces) that are colder than  $-7^{\circ}\text{C}$  ( $19.4^{\circ}\text{F}$ ). Warn workers to avoid skin contact with these surfaces.
- e. Hands should be protected by mittens if air temperature is  $-17.5^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) or less.
- f. Tools and machine controls to be used in cold conditions should be designed for operation by gloved hands.

### **I-6.5 Training**

Before working in extreme cold, workers should be instructed in safety and health procedures.

Training should cover the following:

- Proper clothing and equipment
- Safe work practices

- Guidelines for eating and drinking
- Risk factors that increase the health effects of cold exposure
- How to recognize signs and symptoms of frostbite
- How to recognize signs and symptoms of hypothermia
- Appropriate first aid treatment, including re-warming procedures.

#### **I-6.6 Exposure Limits, Work Schedules, and Wind Chill**

The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted the guidelines developed by the Saskatchewan Labour for working outdoors in cold weather conditions. These guidelines recommend protective clothing and limits on exposure time (**Table I-6-2**). The recommended exposure times are based on the wind chill factor, a scale based on air temperature and wind speed. The work-break schedule applies to any 4-hour period with moderate or heavy activity. The warm-up break periods are of 10-minute duration in a warm location. The schedule assumes that “normal breaks” are taken once every 2 hours. At the end of a 4-hour period, an extended break (for example, lunch break) in a warm location is recommended. More information is available in the ACGIH publications *2006 TLVs and BEIs* and *Documentation of TLVs and BEIs* and on the Saskatchewan Labour Web page [Cold Conditions Guidelines for Outside Workers](#).

#### **I-6.7 First Aid**

If fingers or hands become either painfully cold, or have lost sensation, bring them inside your clothing against warm, bare skin.

If toes or feet become numb or cold, get to a shelter, loosen or remove boots and socks and allow full re-warming, drying, and recovery before re-entering the cold.

If you suspect there is frostbite of toes or feet, do not massage or walk on them. If it is on the fingers and hands, do not rub or use them. Keep cold damaged extremities immobile, protect them with warm, dry clothing and seek medical help immediately. Do not attempt any self-treatment beyond the following.

- Only thaw hands or feet if medical aid is distant and there is no chance of refreezing. Parts are better thawed at a hospital.
- If medical aid is distant, warm frostbitten area gradually with body heat. Do not rub.
- Apply sterile dressings to blisters to prevent breaking.
- Get medical attention as soon as possible.

Cold exposed people who are sleepy, lethargic, slow to respond, or who begin behaving strangely may be hypothermic. Profoundly hypothermic people will appear to be dead, even to experienced medical and paramedical professionals. Do not attempt to treat them yourself. Take no chances, demand emergency medical help. Until medical help arrives, do the following.

- Carefully remove casualty to shelter. Sudden movement or rough handling can upset heart rhythm.
- Gently keep casualty awake. Talk to the casualty to maintain their attention and keep them awake. Avoid strong shaking to keep the casualty awake.



- Remove wet clothing and wrap casualty in warm covers.
- Re-warm neck, chest, abdomen, and groin – but not extremities.
- Apply direct body heat (lie next to the casualty).
- Give warm, sweet drinks, but only if casualty is conscious.
- Monitor breathing. Administer artificial respiration if necessary.
- Call for medical help or transport casualty to nearest medical facility.

If trench foot or immersion foot is suspected, soak the feet in warm water, then wrap them with dry cloth bandages. Drink a warm, sugary drink. Seek medical attention.

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**APPENDIX I-7**  
**LOCKOUT AND TAGOUT PROCEDURES FOR THE EDS**

## **APPENDIX I-7**

### **LOCKOUT AND TAGOUT PROCEDURES FOR THE EDS**

#### **I-7.1 Purpose**

Explosive Destruction System (EDS) workers will be protected from energy sources during maintenance activities by utilizing Lockout/Tagout Procedures that comply with Occupational Safety and Health Administration (OSHA) regulation 29 Code of Federal Regulations (CFR) 1910.147. This standard mandates training, audits, and recordkeeping to ensure that workers will not be injured by unintentionally energized equipment.

These procedures establish the requirements for the lockout and tagout of energy-isolating devices whenever maintenance or servicing is done on equipment associated with the EDS.

#### **I-7.2 Definitions**

- *Affected Employee.* An employee whose job requires him/her to operate or use any equipment on which servicing or maintenance is being performed under lockout and/or tagout; or whose job requires him/her to work in an area in which this servicing or maintenance is being performed.
- *Authorized Employee.* An employee who locks out or tags out equipment to perform servicing or maintenance. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered in this procedure and he/she has been trained in lockout and tagout procedures.

- *Control Authority.* An authorized employee administers the lockout and tagout program.
- *Energized.* Connected to an energy source or containing residual or stored energy.
- *Energy-Isolating Device.* A mechanical device that physically prevents the transmission or release of energy, such as the following:
  - Manually operated electrical circuit breaker
  - Disconnect switch
  - Line valve
  - Block.

Note: Push buttons, selector switches, and other control circuit-type devices are not energy-isolating devices.

- *Energy Source.* Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other sources specific to EDS.
- *Lockout.* The placement of a lock, either key or combination type, on an energy-isolating device to ensure that the energy-isolating device and the equipment being controlled cannot be operated until the lock is removed.
- *Servicing and/or Maintenance.* Any work performed on the equipment to ensure ongoing performance; that is, preventive maintenance, or to repair or replace failed equipment. Note: Work on equipment that is a repetitive

operating requirement; that is, opening the Containment Vessel door to remove munition or Department of Transportation (DOT) cylinder parts after detonation and decontamination, and is under the direct control of operating personnel, will be covered in Standing Operating Procedures (SOPs) and are not subject to this procedure.

- *Tagout.* The placement of a Danger tag on an energy-isolating device to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tag is removed.
- *Zero Energy State.* The equipment condition where every energy source has been isolated, dissipated, or blocked off and the equipment secured against accidental movement.

### **I-7.3 Responsibility for Lockout/Tagout**

The EDS System Operations Manager/Commander is responsible for the EDS lockout/tagout program for the duration of the site operations.

The EDS System Operations Manager/Crew Chief will:

- Authorize all maintenance activities
- Ensure that a lock and tag plan that addresses isolation of energy sources and the means for isolating them is developed for each maintenance activity
- Ensure that operating personnel are aware of the maintenance activity and prepare the equipment for lockout/tagout

- Periodically audit lockout/tagout operations to ensure compliance with procedures and to evaluate the effectiveness of the lockout/tagout procedure.

The employees who will be performing the maintenance activity will be responsible for doing the required locking and tagging.

#### **I-7.4 Training Requirements**

Authorized employees must be trained to:

- Recognize sources of hazardous energy
- Identify the type and magnitude of energy found in the EDS
- Understand the means and methods of isolating and/or controlling energy
- Understand the means of verification of effective energy control
- Know the purpose of procedures to be used.

All affected employees must be instructed by a qualified instructor in the purpose and use of the lockout/tagout procedures.

#### **I-7.5 Recordkeeping Requirements**

The following records of lockout and tagout activities must be kept on file for the duration of the EDS operation:

- Personnel training records

- A log of lockout and tagout activity
- Any audit records.

## **I-7.6 Standard Lockout/Tagout Procedure**

The attached Standard Lockout/Tagout Procedure will apply to the EDS operations.

### **STANDARD LOCKOUT/TAGOUT PROCEDURE**

#### **Requirements:**

EDS maintenance personnel shall use the following special precautions when performing the standard lockout/tagout procedure:

- Lock out all energy source isolating devices that are capable of being locked out. New, modified, or retrofitted equipment or systems that have hazardous energy sources shall be capable of being locked out.
- Always assume capacitors or associated equipment are energized until they are verified as deenergized.
- **Do not** use control circuit devices, such as push buttons, key interlock switches, selector switches, and door interlocks as the sole means for deenergizing circuits or equipment.
- When neutralizing energy sources, never rely on secondary protection, such as interlocks, control, or micro or limit switches that could either malfunction or be operated or bypassed without prior knowledge.



The standard lockout/tagout procedure is as follows:

Step	Action
<b>Step 1:</b> Notify personnel	Notify equipment operators and affected personnel in the vicinity that the equipment or system will be shut down and lockout/tagout devices will be applied. This includes recording the activity in the lockout/tagout log.
<b>Step 2:</b> Preview the procedures	<p>Preview the procedures as follows:</p> <ul style="list-style-type: none"> <li>• Check with the System Operations Manager/Commander to determine if a facility- or equipment-specific lockout/tagout procedure must be followed or if the standard lockout/tagout procedure can be used.</li> <li>• Review the steps of the standard lockout/tagout procedure.</li> <li>• Recheck to ensure that the correct system is being locked out.</li> <li>• Verify that the energy source isolating devices (for example, circuit breakers, disconnect switches, valves) are the correct ones for the equipment or the system on which work is performed.</li> <li>• Unless switches and valves are located so that their functions are obvious, make sure that all switches and valves are labeled adequately to indicate their functions.</li> <li>• Ensure that energy-source isolating devices will accept a lockout device.</li> <li>• Ensure that there are no other sources of energy that must be isolated. These are sources that could backfeed energy into the equipment (for example, batteries in uninterruptible power sources and check valves in pressure systems).</li> <li>• Determine if any related systems need to be shut down.</li> <li>• Put on any necessary <u>personal protective equipment (PPE)</u>.</li> </ul>

Step	Action
<b>Step 3:</b> Deenergize sources of energy	De-energize sources of energy as follows: <ul style="list-style-type: none"> <li>• Use the normal shutdown procedures to stop or turn off equipment. The equipment operator or <u>lockout/tagout-authorized personnel</u> may perform this task.</li> <li>• Locate and operate all energy-source isolating devices that control the energy to the machine or equipment to isolate the machine, equipment, or system from the energy source.</li> </ul>
<b>Step 4:</b> Apply locks and tags	Apply locks and tags as follows: <ul style="list-style-type: none"> <li>• Attach a personal danger tag to each lock.</li> <li>• Attach locks and lockout devices to energy source isolating devices to hold them in the “safe” or “off” position.</li> </ul>
<b>Step 5:</b> Block or relieve stored energy sources	<div data-bbox="808 856 982 940" data-label="Image"> </div> <p><b>Warning:</b> Merely isolating energy sources is not sufficient for safety; stored electrical or mechanical energy must be neutralized.</p> <p>Identify and neutralize energy sources as follows:</p> <ul style="list-style-type: none"> <li>• Check all energy sources by doing any of the following that apply: <ul style="list-style-type: none"> <li>- Lower suspended parts to the lowest or rest position whenever possible.</li> <li>- Block movable parts.</li> <li>- Drain or bleed pressurized liquid or hydraulic lines.</li> <li>- Release or block spring energy.</li> </ul> </li> </ul>

Step	Action
<b>Step 5:</b> Block or relieve stored energy sources (continued)	<ul style="list-style-type: none"> <li>- Isolate external battery banks from electrical or electronic circuits.</li> <li>- Vent air pressure from pneumatic lines, pressure reservoirs, accumulators, and air surge tanks. If pressure cannot be relieved, block any possible movement.</li> <li>• Make sure that all moving parts in a danger zone have stopped before entering the area.</li> <li>• Review the entire cycle of the equipment's mechanical motion to avoid being caught by surprise by a sudden movement.</li> <li>• Discharge and ground capacitors and high-capacitance elements.</li> <li>• Isolate battery banks within equipment or systems to prevent circuits from reenergizing when the primary power source is deenergized (for example, battery banks of uninterruptible power systems).</li> <li>• Block or relieve stored nonelectrical energy in devices that could reenergize electric circuit parts.</li> <li>• If energy could possibly reaccumulate, continually relieve it or short it out until the accumulation is completely neutralized.</li> </ul>
<b>Step 6:</b> Verify-perform final safety check	<p>Perform the final safety check as follows:</p> <ul style="list-style-type: none"> <li>• Take voltmeter measurements at the terminals of each incoming power source and energy storage device within the equipment to verify a <b>zero voltage</b> condition.</li> <li>• Read the pressure gauges on equipment to verify that energy sources are disconnected and stored energy is released.</li> <li>• Verify that stored energy is either released or restrained.</li> </ul> <p>Try to restart the equipment by using the on-off and startup controls. Return the controls to the OFF position.</p>

Step	Action
<b>Step 6:</b> Verify-perform final safety check (continued)	<div data-bbox="808 367 982 451" data-label="Image"> </div> <p><b>Warning:</b> When testing any electrical system, check test equipment for proper operation immediately before and after performing this step.</p> <ul style="list-style-type: none"> <li>Verify that the circuit elements and equipment parts are deenergized and, if any inadvertently induced voltage or unrelated voltage backfeed exists, test exposed circuit elements to which workers will be exposed with the appropriate test equipment.</li> </ul>
<p><b>Servicing Equipment</b></p> <div data-bbox="215 724 386 808" data-label="Image"> </div> <p><b>Warning:</b> Do <b>not</b> enter a danger zone until certain that:</p> <ul style="list-style-type: none"> <li>No hazardous motion or shock is probable.</li> <li>All energy sources are disconnected.</li> <li>Each movable part has been inspected to ensure that it is at rest.</li> <li>All tests recommended for the equipment have been performed.</li> <li>Stored energy is released, discharged, or restrained, and electrical components have been appropriately grounded.</li> </ul> <p><b>Note:</b> The System Operations Manager/Commander shall direct <u>servicing</u> activities only after verifying deenergization of equipment.</p>	
<p><b>Testing and Repositioning Equipment</b></p> <p>In situations in which the energy-isolating devices are locked and tagged and there is a need to restart the equipment for testing or repositioning, do the following:</p> <ul style="list-style-type: none"> <li>Perform <u>Step 7: Restart equipment</u>.</li> <li>Perform testing and repositioning.</li> <li>Repeat Steps 1 through 6 before continuing servicing activities to reverify that isolation and deenergization have been accomplished and to continuously relieve energy that may reaccumulate.</li> </ul>	
<b>Step 7:</b> Restart equipment	<p>Restart equipment as follows:</p> <ul style="list-style-type: none"> <li>Notify the equipment operator and anyone in the vicinity that the equipment is being restarted.</li> <li>Warn anyone who may be exposed to the hazards associated with reenergizing equipment to stay clear of the equipment.</li> <li>Ensure the following:             <ul style="list-style-type: none"> <li>A lockout/tagout-authorized person conducts the necessary tests and visual inspections to verify that all tools, electrical jumpers, shorts, grounds, and other such devices are removed so that the circuits and equipment can be safely energized.</li> </ul> </li> </ul>

Step	Action
<b>Step 7:</b> Restart equipment (continued)	<ul style="list-style-type: none"> <li>- The required servicing is complete and the equipment is in operating condition.</li> <li>- All guards are in place.</li> <li>- Any braces, pins, locks, chains, or other restraints have all been removed and movable parts are unblocked.</li> <li>- All pressure tubing, pipes, and hoses are reconnected, and equipment or system valves are set to their appropriate closed or open position.</li> <li>- All tools, parts, and debris are removed from the system and the work area is clear.</li> <li>- Everyone is clear of potential danger zones.</li> <li>- Everyone in the area is wearing required PPE for <u>normal operations</u>.</li> <li>• Remove locks, lockout devices, and tags.</li> <li>• Be alert for possible movements that may take place when the equipment is reenergized.</li> <li>• Operate energy-source isolating devices in the sequence identified in the equipment-specific procedure.</li> <li>• Reenergize the equipment or system through normal starting procedures. The equipment operator or a lockout/tagout-authorized person can perform this task.</li> </ul>
<b>Step 8:</b> Notify personnel of reenergization	Notify anyone who may be affected by reenergization that the process has been completed and that the equipment has been reenergized.

## EQUIPMENT-SPECIFIC LOCKOUT/TAGOUT PROCEDURE

### Requirements:

The System Operations Manager/Commander shall ensure that equipment-specific procedures comply with the requirements in this document and, at a minimum, shall document the steps for the following activities:

- Notify affected individuals.
- Preview procedures.
- Apply locks and tags.
- Identify and neutralize energy sources.
- Perform final safety check.
- Restart equipment.

### LOCK AND TAG REMOVAL WHEN THE WORKER WHO APPLIED THEM IS ABSENT

#### Requirements:

**Note:** In normal circumstances, only the lockout/tagout-authorized worker who originally attached the lock and tag shall remove it. However, if that worker is unavailable (for example, is on vacation or sick leave), the manager or a designee named on the back of the danger tag may assign another worker to complete the servicing and to restart the equipment.

Managers shall ensure that the following procedure is used to remove locks and tags in the absence of the worker who attached them:



**Warning:** Leaving a voice message or sending an e-mail to inform an individual that their locks and tags have been removed **does not constitute “informing the individual” and is a violation of federal law.**

Step	Action
1	Verify that the worker whose locks and tags are to be removed is <b>not</b> at the facility before removing the devices.
2	Make all reasonable efforts to contact the worker at home and to determine the status of the work and the reasons that the worker who attached the lock and tag did <b>not</b> remove them.
3	Notify affected personnel that responsibility for lockout/tagout is being transferred.
4	Have another lockout/tagout-authorized worker remove the lock and tag. <b>Note:</b> The lock may be removed with bolt cutters or other metal-cutting tools.

Step	Action
5	Have the worker who completes the servicing activities install another lock and tag and conduct final safety checks per Step 6 of the standard lockout/tagout procedure (see “Standard Lockout/Tagout Procedure”), including reverification of deenergization prior to any work on the equipment, process, or system.
6	Ensure that the worker whose locks are removed is informed of the removal either by telephone or immediately upon when the worker’s return to work.
7	Document manager-authorized lock removal and update the lockout/tagout log.

## ANNUAL INSPECTIONS

### Performing Annual Lockout/Tagout Implementation Inspections

#### Requirements:

Managers shall ensure that annual inspections of **all** activity- or equipment-specific lockout/tagout procedures and their implementation are conducted.

A lockout/tagout-authorized person other than those who use the lockout/tagout procedure being assessed (for example, a lockout/tagout-authorized worker from another department) shall conduct the inspection. This reviewer shall:

- Ensure that the procedures comply with the latest revision of this document and that any changes in the equipment or system that may have occurred are properly reflected in the procedures.
- Check that personnel training is current.
- Observe a demonstration of the procedures.
- Identify and document inadequacies observed in the procedure and its implementation.
- Verify that lockout/tagout procedures are being followed exactly as documented.
- Review the responsibilities of all authorized personnel (and all affected personnel if tagout-only procedures are used) under the lockout/tagout procedure. The reviewer may accomplish this by holding group meetings with authorized personnel.

## **Correcting Deviations or Inadequacies**

### **Requirements:**

EDS Managers shall ensure that any deviations or inadequacies observed in procedures, training, or implementation are corrected before the lockout/tagout procedure is performed again.

## **Documentation of Annual Inspections**

A lockout/tagout-authorized person other than those who use the lockout/tagout procedure being assessed (for example, a lockout/tagout-authorized worker from another department) shall document the annual inspection findings and corrective actions.

### **Requirements:**

Managers shall document annual inspections, including:

- The name of the equipment or facility for which the lockout/tagout procedure is written
- Date of the review
- Names of the lockout/tagout-affected and -authorized personnel included in the review
- Statement of review findings, deficiencies, and corrective actions required
- Name of the person who performed the review.

## **MANAGER'S SELF-ASSESSMENT OF LOCKOUT/TAGOUT**

### **Guidance:**

Managers should:

- Evaluate the adequacy of their lockout/tagout implementation with regard to OSHA and DOE requirements by performing a self-assessment against pre-established criteria.
- Use the Lockout/Tagout Self-Assessment form (SF 2001-LSA) to complete and record the results of the lockout/tagout self-assessment.



## REFERENCES

### Requirements Source Documents:

29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*.

DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

### Implementing Documents:

SNL, MN471001, *ES&H Manual*, Section 4C, "Lockout/Tagout for the Control of Hazardous Energy."

### Related Documents:

29 CFR 1910.269, *Electric Power Generation, Transmission, and Distribution*.

29 CFR 1910.333, *Selection and Use of Work Practices*.

29 CFR 1926.417, *Lockout and Tagging of Circuits*.

ANSI/NFPA 70E, *Electrical Safety Requirements for Employee Work Places*, 1995.

DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*.

SNL, MN471001, *ES&H Manual*, Chapter 21, *Technical Work Documents (TWDs)*.

## **APPENDIX I-8**

### **EXAMPLE EDS DAILY SITE-SPECIFIC BRIEFING SITE LOCATION**

**APPENDIX I-8**  
**EXAMPLE EDS DAILY SITE-SPECIFIC BRIEFING SITE LOCATION**

<b>Topics Covered:</b>	<b>Completed/Initials</b>
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<b>Safety Team POCs</b>	_____
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- Name – EDS System Operations Manager, PMNSCM
- Name – EDS Crew Chief
- Name – Data Collection
- Name – Safety Representative, PMNSCM
- Name – Site Safety Representative (SHO)

<b>Weather Forecast</b>	_____
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<b>Heat Injuries</b>	_____
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- Heat stress
- Exhaustion
- Stroke

## **Slips, Trips, and Falls**

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- Steep inclines
- Partially buried fencing/barbed wire
- Muddy/wet surfaces

## **PPE Levels**

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- Agent operations - level C
- Industrial operations - in accordance with SHERP
- Personnel Decontamination Station (PDS) crew - level C
- All other personnel - level D

## **Safe Work Practices**

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- Equipment spotters
- Recognized hand signals
- Proper lifting techniques

## **Emergency Procedures/Rally Point**

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- Emergency signals:
  - Within engineering controls: one 3-second blast
  - Outside engineering controls: two 3-second blasts.
- Rally point

## **Biological Hazards**

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- Poison ivy/oak/sumac
- Snakes (king/rattlers/gopher/long-nosed/night)
- Bees/wasps
- Spiders (hobo/black widow/tarantula/wolf/yellow sac/)
- Mosquitoes

## **Radio Sign In/Out**

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- Channel frequency (Nextel Talkabouts and Motorolas: Channel 1, switch at "A")
- Communications checks (Twice all site elements – team downrange)

### **Vehicle/Heavy Equipment Traffic**

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- Use of seat belts
- Sound horn prior to backing vehicles without warning device
- Vehicle speeds on roads and in compound – 5 mph

### **Electrical Hazards**

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- Proper use of generators

### **Chemical Hazards**

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- Chemicals of Concern
- Symptoms
- Exposure Pathways

### **MSDS Logs/Records**

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- Located in Command Post Trailer

### **Hospital/Routes**

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- Maps to hospitals located in Command Post
- All injuries will be reported to system manager, and safety representatives

- Onsite personnel will transport site personnel or call for ambulance support.

**Today's Operations** (None)

- Review Op Order

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PMNSCM Representative Signature

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Date

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**APPENDIX I-9**  
**PERSONAL PROTECTIVE EQUIPMENT**

## **APPENDIX I-9**

### **PERSONAL PROTECTIVE EQUIPMENT**

Personal protective equipment (PPE) will be selected based on guidance in Department of the Army Pamphlet (DA Pam) 385-61 and 29 Code of Federal Regulations (CFR) 1910.132 and 138. **Table I-9-1** of this appendix describes PPE levels, indicating the hazards each level is designed to protect against and the equipment required to meet that level of protection. Selection of commercial protective equipment will be in accordance with DA Pam 385-61. Commercial PPE with generic approval are listed in a DA Safety memorandum dated 28 February 2002, Subject: Generic Approval of Commercial Chemical Protective Equipment.

Table I-9-1. Personal Protective Equipment

Description	Equipment
<p><b>Level A</b></p> <p>Level A is suitable for situations where the highest level of respiratory, skin, and eye protection are desired. Level A PPE should be used in workplaces where there is a measured (or potential for) high concentrations of dusts, fumes, mists, or vapors that present a respiratory hazard and where there is a high potential for splash or immersion into chemicals that present a skin hazard. Level A PPE also should be used when working with extremely hazardous substances, DOT poison "A" materials, known or suspected human carcinogens, and infectious agents where skin contact is possible. The chemical protective items used will be selected to be compatible with the chemicals of concern against which protection is required.</p>	<p>Respirator</p> <ul style="list-style-type: none"> <li>Positive pressure NIOSH-approved SCBA or tethered positive-pressure air supplied respirator with escape bottle</li> </ul> <p>Outer Clothing</p> <ul style="list-style-type: none"> <li>Fully encapsulating (vapor-tight), chemical resistant suit</li> </ul> <p>Inner clothing</p> <ul style="list-style-type: none"> <li>Undershirt, underwear, and socks</li> <li>Coveralls (optional)</li> </ul> <p>Gloves</p> <ul style="list-style-type: none"> <li>Chemical resistant over glove</li> <li>Chemical resistant inner glove (part of the suit)</li> </ul> <p>Boots</p> <ul style="list-style-type: none"> <li>Chemical resistant, steel toe and shank safety boot (depending on suit design, may be incorporated into the suit or worn over or under the suit boot)</li> </ul> <p>Communication</p> <ul style="list-style-type: none"> <li>Intrinsically safe 2-way radio</li> </ul>

Table I-9-1. Personal Protective Equipment (Continued)

Description	Equipment
<p><b>Level B</b></p> <p>Level B PPE is suitable for situations where the highest level of respiratory protection is needed but a lesser level of skin protection is required. This includes environments with hazardous dust, fume, mist, or vapor concentrations exceeding the IDLH level or concentrations exceed the limits of protection afforded by a full-face air purifying respirator and where the work operations, substances, or concentrations do not represent a serious skin hazard. Level B may be used in atmospheres containing less than 19.5 percent oxygen. The type of chemical resistant clothing selected will be compatible with the chemicals of concern against which protection is required.</p>	<p>Respirator</p> <ul style="list-style-type: none"> <li>Positive pressure NIOSH-approved SCBA or tethered positive-pressure air supplied respirator with escape bottle</li> </ul> <p>Outer Clothing</p> <ul style="list-style-type: none"> <li>Chemical resistant clothing (overalls and long-sleeved jacket; coveralls; hooded one- or two-piece chemical splash suit; or disposable chemical resistant coveralls)</li> </ul> <p>Inner clothing</p> <ul style="list-style-type: none"> <li>Undershirt, underwear, and socks (coveralls optional)</li> <li>Chemical protective undergarments (optional for HD operations)</li> </ul> <p>Gloves</p> <ul style="list-style-type: none"> <li>Chemical resistant outer gloves</li> </ul> <p>Boots</p> <ul style="list-style-type: none"> <li>Chemical resistant (chemical resistant safety boot with steel toe and shank or a chemical resistant boot worn over safety shoes)</li> </ul> <p>Headgear</p> <ul style="list-style-type: none"> <li>Hardhat (optional)</li> </ul> <p>Splash Protection</p> <ul style="list-style-type: none"> <li>Face shield (optional)</li> </ul> <p>Communication</p> <ul style="list-style-type: none"> <li>Intrinsically safe 2-way radio</li> </ul>

Table I-9-1. Personal Protective Equipment (Continued)

Description	Equipment
<p><b>Level C</b></p> <p>Level C PPE is suitable for situations where a lesser level of respiratory protection is required. Typically, the level of contamination that must be protected against has been measured and does not exceed the concentration for which the air-purifying respirator is designed and where there is little risk of splash or immersion with liquid contaminants. The type of filter used with the respirator will be selected based on the chemical(s) of concern against which protection is required. Level C PPE may not be used in situations where the oxygen concentration is below 19.5 percent.</p>	<p>Respirator</p> <ul style="list-style-type: none"> <li>• Full-face, air-purifying NIOSH-approved, or military mask</li> </ul> <p>Outer Clothing</p> <ul style="list-style-type: none"> <li>• Chemical resistant clothing (overalls and long-sleeved jacket, coveralls, hooded one- or two-piece chemical splash suit, or disposable chemical resistant coveralls)</li> </ul> <p>Inner clothing</p> <ul style="list-style-type: none"> <li>• Undershirt, underwear, and socks</li> <li>• Coveralls (optional)</li> </ul> <p>Gloves</p> <ul style="list-style-type: none"> <li>• Chemical resistant over glove</li> </ul> <p>Boots</p> <ul style="list-style-type: none"> <li>• Chemical resistant, steel toe and shank safety boot (depending on suit design, may be worn over or under the suit boot)</li> </ul> <p>Splash Protection (optional)</p> <ul style="list-style-type: none"> <li>• Face shield</li> <li>• Chemical resistant apron</li> </ul>

Table I-9-1. Personal Protective Equipment (Continued)

Description	Equipment
<p><b>Level D</b></p> <p>Level D is suitable for situations where there is little risk of exposure to a respiratory hazard above the action level. Level D may incorporate various forms of skin protection such as gloves, boots, face shields, and aprons for situations where there is a potential skin hazard but no respiratory hazard.</p>	<p>Respirator</p> <ul style="list-style-type: none"> <li>Full-face, air-purifying NIOSH-approved or military mask worn in slung position or readily available</li> </ul> <p>Outer Clothing</p> <ul style="list-style-type: none"> <li>Work clothes: coveralls, laboratory coat, military uniform, or other employer issued clothing</li> </ul> <p>Inner clothing</p> <ul style="list-style-type: none"> <li>Undershirt, underwear, and socks</li> </ul> <p>Gloves</p> <ul style="list-style-type: none"> <li>Work gloves (optional)</li> <li>Chemical resistant gloves with or without sleeves (optional)</li> </ul> <p>Boots</p> <ul style="list-style-type: none"> <li>Work boot/shoe</li> <li>Chemical resistant, steel toe and shank safety boot (optional)</li> </ul> <p>Splash Protection</p> <ul style="list-style-type: none"> <li>Face shield (optional)</li> <li>Chemical resistant apron (optional)</li> </ul>

Notes:

DOT = Department of Transportation  
IDLH = immediately dangerous to life and health  
NIOSH = National Institute for Occupational Safety and Health  
PPE = personal protective equipment  
SCBA = self-contained breathing apparatus

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**APPENDIX I-10**  
**PERMA-SLIK MSDS**



## MATERIAL SAFETY DATA SHEET

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PERMA-SLIK RAC

PRODUCT NAME: PERMA-SLIK RAC  
PRODUCT CODE: PPSRAC

HMIS CODES    H F R P  
                  2 3 0 B

### 1. MANUFACTURING IDENTIFICATION

EVERLUBE PRODUCTS  
100 COOPER CIRCLE  
PEACHTREE CITY, GA 30269  
EMERGENCY PHONE: CHEMTREC - 800-424-9300

DATE PREPARED: 12/9/2008  
INFORMATION PHONE: (770) 261-4800  
NAME OF PREPARER: CHEMICAL COMMUNICATIONS COORDINATOR

### 2. HAZARDOUS INGREDIENTS

COMPONENT/EXPOSURE LIMITS	CAS#	% BY WT.
HEPTANE	142-82-5	45% - 50%
400 ppm ACGIH TWA		
500 ppm ACGIH STEL		
500 ppm OSHA TWA		
750 ppm NIOSH IDLH		
LD 50 ORAL >2000 mg/kg (RAT)		
LD 50 DERMAL >2000 mg/kg (rat)		
LC50 INHALATION >5000 ppm/1 hour (rat)		
MOLYBDENUM DISULFIDE	1317-33-5	15% - 20%
ACGIH TWA I 10 mg/m3		
ACGIH TWA R 3 mg/m3		
LD50/LC50: 500 mg Acute Oral (rats)		
VM&P NAPHTHA	64742-89-8	10% - 15%
OSHA VPEL 1350.000 mg/m3 - TWA		
OSHA VPEL 300.000 ppm - TWA		
OSHA VPEL 1800.000 mg/m3 - STEL		
OSHA VPEL 400.000 ppm - STEL		
ACGIH TLV 300.000 ppm - TWA		
ACGIH TLV 1370.000 mg/m3 - TWA		
LD 50 ORAL 8000 mg/kg (rat)		
LC50 INHALATION 3400 ppm 4 h (Rat)		
LD50 4000 DERMAL mg/kg (rat)		
XYLENE	1330-20-7	0% - 5%
ACGIH TLV: 100 PPM		
OSHA PEL: 100 PPM		
ACGIH STEL: 150 PPM		
LD50/LC50:		
LD50:>2000mg/kr (rat)		
LD50: >2000 mg/kr (rabbit)		
LD50: >5000 ppm/1 hour (rat)		
ETHYL BENZENE	100-41-4	0% - 5%
OSHA PEL 100 ppm-TWA		
OSHA VPEL 100 ppm-TWA		
OSHA VPEL 125 ppm-STEEL		
ACGIH TLV 100 ppm-TWA		
ACGIH TLV 125 ppm-STEEL		
LD50 ORAL: 3500 mg/kg (rat)		

### 3. HAZARDS IDENTIFICATION

POTENTIAL EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE:

## MATERIAL SAFETY DATA SHEET

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### PERMA-SLIK RAC

Processing fumes may cause irritation of the eyes and respiratory tract. Use with adequate ventilation. Avoid breathing process fumes.

#### EYE CONTACT:

This material can cause eye irritation.

#### SKIN CONTACT:

Prolonged and repeated contact with the skin can cause defatting and drying of the skin resulting in skin irritation and skin rash (dermatitis).

#### INHALATION:

Inhalation of high concentrations of solvents may cause narcotic effects such as headaches, dizziness, nausea, vomiting and coma.

#### INGESTION:

May cause adverse health effects and can cause gastro-intestinal irritation.

#### POTENTIAL EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE:

No specific information is available regarding long-term exposure to this material. Other information on any known toxic or chronic-health effects of the material or its ingredients can be found in Section 11 - Toxicological Information.

### 4. FIRST AID MEASURES

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#### EYE CONTACT:

With eyelids open, immediately flush eyes with lots of lukewarm water for at least 30 minutes. Get immediate Medical Assistance.

#### SKIN CONTACT:

Wash the skin thoroughly with plenty of water for at least 15 minutes, using a mild and non-abrasive soap. Cold water may be used

Consult a doctor if irritation persists.

#### INHALATION:

Evacuate to fresh air and administer artificial respiration if breathing stopped. Obtain Medical Aid.

#### INGESTION:

Never give anything by mouth if the victim is semi-conscious, unconscious or convulsing.

Seek immediate medical attention.

Induce vomiting immediately by giving 2 glasses of water and stimulating the uvula with a finger.

#### NOTE TO PHYSICIANS:

The main hazard following accidental ingestion is aspiration of the liquid into the lungs producing chemical pneumonitis. If more than 2.0 ml/Kg has been ingested, vomiting should be induced with supervision. If symptoms, such as loss of gag reflex, convulsions or unconsciousness occur before vomiting, gastric lavage with a cuffed endotracheal tube should be considered.

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**PERMA-SLIK RAC**

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**5. FIRE FIGHTING MEASURES**

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**FLAMMABLE PROPERTIES:**

Vapors may form, with air, an explosive mixture between lower and upper explosive limits.

FLASH POINT (DEGREES F.) .....: 15 F  
FLASH POINT METHOD .....: TCC  
LOWER FLAMMABILITY LIMIT (% BY VOLUME): .9  
UPPER FLAMMABILITY LIMIT (% BY VOLUME): 7.0  
AUTO-IGNITION TEMPERATURE.....: n/a

**HAZARDOUS DECOMPOSITION PRODUCTS:**

Irritating and toxic fumes including the following may be released:  
Carbon, Sulfur, Hydrogen Sulfide, and Chlorine

**UNUSUAL FIRE AND EXPLOSION HAZARDS:**

Avoid accumulation of water. Product will float on water and may reignite on surface of water.

Closed containers may explode due to pressure build-up when exposed to extreme heat.

DO NOT cut, drill, grind or weld near containers even when empty. Residual product or vapours may ignite or explode.

Extinguish all nearby sources of ignition.

**EXTINGUISHING MEDIA:**

CO2, foam, dry chemical or halon

**FIREFIGHTING PROCEDURES / EQUIPMENT:**

Extinguish all nearby sources of ignition.

Use water spray to cool containers and structures exposed to fire.

Fire-Fighters should wear self-contained breathing apparatus and full protective equipment.

**6. ACCIDENTAL RELEASE MEASURES**

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**PERSONAL PRECAUTIONS:**

Emergency personnel must wear the following protective equipment: self-contained breathing apparatus, protective clothing, safety goggles and boots.

Evacuate all personnel not related to emergency procedures.

**ENVIRONMENTAL PRECAUTIONS:**

Prevent the product or the wash waters from entering the water system or sewers.

US regulations require reporting spills of this material that could reach any surface waters. In Canada, report to the applicable provincial environment ministry.

**SPILL RESPONSE / CLEANUP:**

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**PERMA-SLIK RAC**

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**SMALL SPILL:**

Eliminate all sources of ignition, provide ventilation, contain spill and absorb with inert absorbent.

Issue warning "Flammable". Isolate the hazard area and restrict access.

Handle as highly flammable liquid.

Wear appropriate breathing apparatus (if applicable) and protective clothing.

Prevent the spill or wash from entering sewers or watercourses.

**LARGE SPILL:**

Remove by mechanical means and place in containers.

**7. HANDLING AND STORAGE**

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**SAFE HANDLING PROCEDURES:**

Maintain good personal hygiene. Avoid breathing processing vapours. Avoid prolonged or repeated skin contact. Wash skin with soap and water after handling. Wash contaminated clothing before re-use.

**STORAGE REQUIREMENTS / CONDITIONS TO AVOID:**

Keep containers closed (when not in use).

Keep away from heat, sparks and flames.

Store in a cool, dry, well ventilated area away from incompatible materials.

Smoking in the area where this material is used should be strictly prohibited.

DO NOT cut, drill, grind or weld near containers even when empty. Residual product or vapours may ignite or explode.

**INCOMPATIBLE MATERIALS:**

Oxidisers, Strong Acids or Alkalies.

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

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**VENTILATION AND ENGINEERING CONTROLS:**

General mechanical ventilation or local exhaust should be suitable to keep vapour concentrations below the threshold limit values.

All ventilation equipment must be explosion proof.

For personal entry into confined spaces (i.e. bulk storage tanks) a proper confined space entry procedure must be followed including ventilation and testing of tank atmosphere. Make-up air should always be supplied to balance air exhausted.

Effective exhaust ventilation should always be provided to draw fumes, vapors or dust away from workers to prevent routine inhalation.

**RESPIRATORY PROTECTION:**

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### PERMA-SLIK RAC

Use NIOSH/MSHA approved Cartridge Respirator or Mask to keep airborne mists and concentrations below the time weighted threshold limit values.

#### SKIN PROTECTION AND GLOVES:

Use Chemically impermeable gloves (eg Neoprene or Nitrile) for skin protection.

#### EYE PROTECTION:

Use chemical Safety Glasses/Goggles and Faceshields. Contact lenses should not be worn without goggles.

#### OTHER PROTECTIVE EQUIPMENT:

Eye wash stations and safety showers in the workplace are recommended.

#### PERMISSIBLE EXPOSURE LEVELS:

PLEASE SEE SECTION 2, HAZARDOUS MATERIALS.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

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SPECIFIC GRAVITY ..... .92473  
POUNDS PER GALLON ..... 7.7 lb/gl  
VOLATILE (% BY VOLUME) ..... Not available  
VOLATILE (% BY WEIGHT) ..... 70%  
BOILING POINT (DEGREES F.) ..... 200F TO 250F  
VOC (EPA Method 24)..... 605 grams/liter  
MELTING POINT..... Not Established.  
EVAPORATION RATE (BUTYL ACETATE=1): Faster than n-Butyl Acetate.  
VAPOR PRESSURE (MM HG AT 20°F.).... Not Available.  
VAPOR DENSITY (AIR=1)..... Heavier than air.  
SOLUBILITY IN WATER ..... Insoluble  
PH ..... Not Applicable.  
APPEARANCE AND ODOR ..... Gray/Black liquid, organic solvent odor

### 10. STABILITY AND REACTIVITY

#### STABILITY AND REACTIVITY:

Stable under normal conditions.

#### CONDITIONS TO AVOID:

Heat, sparks, open flames or other sources of ignition.

#### MATERIALS TO AVOID:

Oxidizers, Strong Acids or Alkalies.

#### HAZARDOUS POLYMERIZATION:

Will not occur.

### 11. TOXICOLOGICAL INFORMATION

#### LD50 / LC50:

Please see Section 2, Hazardous Ingredients.

#### CARCINOGENICITY:

NTP-Yes

IARC-Yes

#### MUTAGENICITY:

None known.

**MATERIAL SAFETY DATA SHEET**  
PERMA-SLIK RAC

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**SENSITIZATION TO MATERIAL:**

None Known

**CONDITIONS AGGRAVATED BY EXPOSURE:**

May aggravate pre-existing skin or respiratory disorders (bronchitis, emphysema, hyper-reactivity) skin allergies, eczema.

**SYNERGYSTIC MATERIALS:**

None known

**12. ECOLOGICAL INFORMATION**

**ENVIRONMENTAL EFFECTS:**

Do not allow product or runoff from fire control to enter storm or sanitary sewers, lakes, rivers, streams, or public waterways. Canadian and U.S. regulations require that environmental and/or other agencies be notified of a spill incident. The spill area must be cleaned and restored to the original condition or to the satisfaction of authorities.

**AQUATIC TOXICITY:**

May be harmful to aquatic life.

**13. WASTE DISPOSAL**

**WASTE MANAGEMENT:**

Waste management priorities (depending on volumes and concentration of waste) are: 1. Recycle (reprocess), 2. Energy recovery (cement kilns, thermal power generation), 3. Incineration, 4. Disposal at a licensed waste disposal facility. Do not attempt to combust waste on-site. Incinerate at a licensed waste disposal site with approval of environment authority

**14. TRANSPORT INFORMATION**

TDG: PAINT RELATED MATERIAL  
CLASS 3, UN1263, PACKING GROUP II

**15. REGULATORY INFORMATION**

**WHMIS CLASSIFICATION:**

B2, D2A, D2B,

**CANADIAN WHMIS:**

THIS PRODUCT HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CONTROLLED PRODUCTS REGULATIONS (CPR), AND THIS MSDS CONTAINS ALL THE INFORMATION REQUIRED BY THE CPR.

OSHA REGULATED: YES

**SARA:**

IF THIS MATERIAL HAS ANY COMPONENTS WHICH ARE REPORTABLE UNDER SARA 313 THEY ARE SHOWN IN THE FOLLOWING LISTING. IF THE LISTING IS BLANK, THEN THERE ARE NO REPORTABLE COMPONENTS.

COMPONENTS REPORTABLE UNDER SARA 313: CAS#	% BY WT.
XYLENE	1330-20-7 0% - 5%

## MATERIAL SAFETY DATA SHEET

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### PERMA-SLIK RAC

ALL COMPONENTS OF THIS PRODUCT ARE ON THE TSCA INVENTORY OR ARE EXEMPT  
FROM TSCA INVENTORY REQUIREMENTS

#### 16. OTHER INFORMATION

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TO THE BEST OF OUR KNOWLEDGE, THE INFORMATION AND RECOMMENDATIONS  
CONTAINED HEREIN IS BELIEVED TO BE ACCURATE AT THE TIME OF  
PREPARATION OR OBTAINED FROM SOURCES BELIEVED TO BE RELIABLE.  
HOWEVER IT IS THE USER'S RESPONSIBILITY TO DETERMINE SAFETY, TOXICITY  
AND SUITABILITY FOR HIS OWN USE OF THE PRODUCT. EVERLUBE PRODUCTS  
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SHOULD ENSURE THAT THE INFORMATION CONTAINED IN THIS MSDS IS MADE  
AVAILABLE TO ALL EMPLOYEES OR OTHER PERSONS WHOME HE KNOWS OR  
BELIEVES WILL USE THIS MATERIAL.

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